The ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXVII
No. 3015

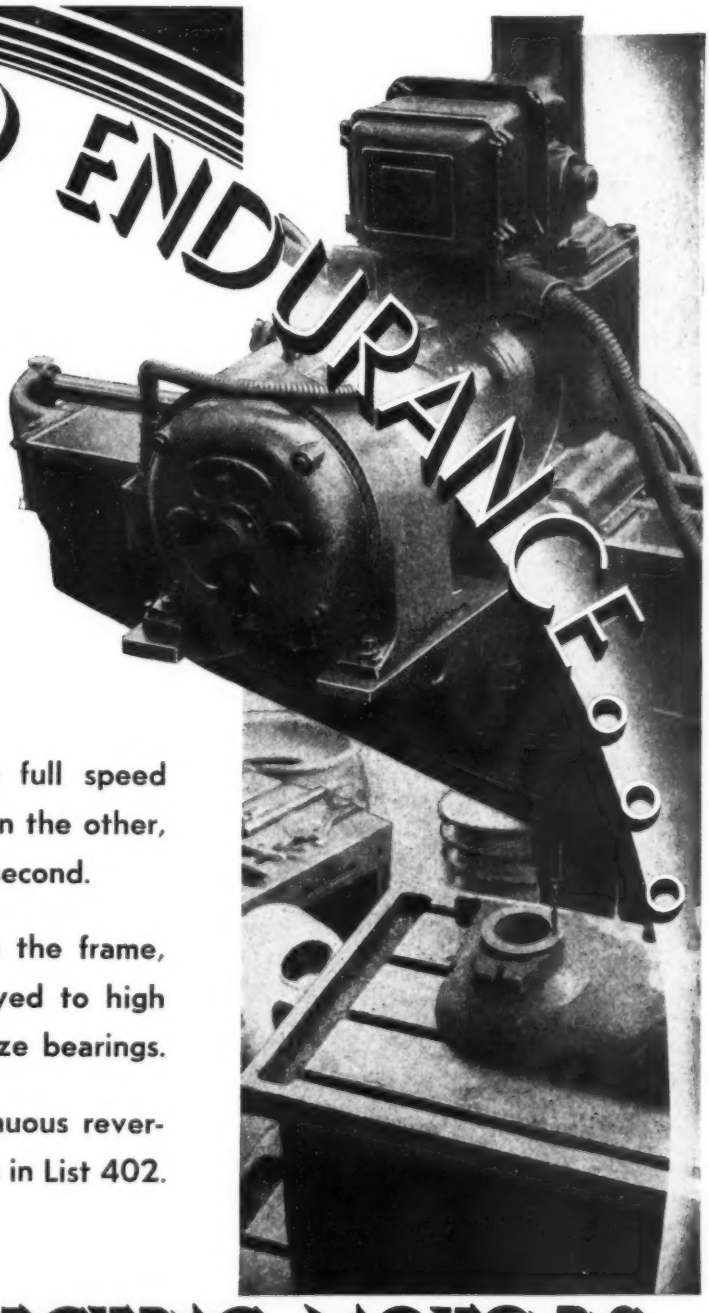
[All Rights Reserved]

SEPTEMBER 6, 1935

[Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage]

PRICE SIXPENCE

RUGGED ENDURANCE



The motor in the illustration is no ordinary type but especially designed for continuous reversal.

Known as our **REVERSING MOTOR,** this class is capable of reversing **30 times per minute on full load,** the period of reversal, from full speed in one direction to full speed in the other, being less than 3/5ths of a second.

All windings are anchored to the frame, the rotor is splined and keyed to high tensile shaft running in oversize bearings.

For use wherever rapid continuous reversal is required. Fullest details in List 402.

BROOK ELECTRIC MOTORS

PRODUCTS OF BROOK MOTORS LTD • EMPRESS WORKS • HUDDERSFIELD

PIONEERS IN INDUCTION MOTOR DESIGN FOR OVER THIRTY YEARS

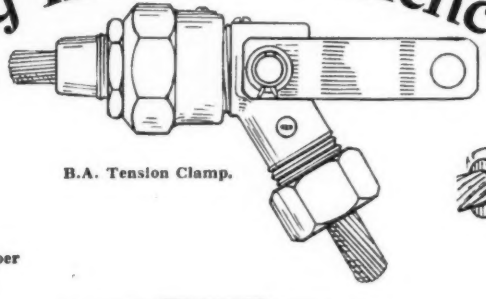
STEEL-CORED ALUMINIUM

***for economy in* supports, insulators, erection and maintenance charges**

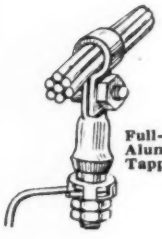
Steel-cored aluminium conductors on the British "Grid" System from Tower No. 28 in S.W. England. (Contractors: Messrs. Johnson & Phillips Ltd.)

ALUMINIUM

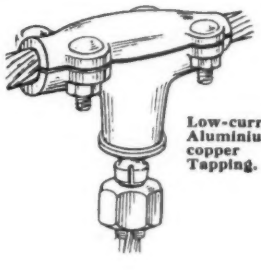
clamps, joints and connectors for long life and efficiency.



B.A. Tension Clamp.



Full-current Aluminium-copper Tapping.



Low-current Aluminium-copper Tapping.

Pairard Tension Joint.

BA The BRITISH ALUMINIUM Co., Ltd.

Head Office: ADELAIDE HOUSE, KING WILLIAM STREET, LONDON, E.C.4

Telephone: MANSION HOUSE 5561 & 8074 (5 LINES). *Telegrams:* CRYOLITE, BILGATE, LONDON

LONDON WAREHOUSE: 25-29, Pancras Road, N.W.1
MANCHESTER: 274, Deansgate
NEWCASTLE-ON-TYNE 1: Milburn House
BIRMINGHAM 4: Lawley Street
LEEDS 3: 66, Kirkstall Road
GLASGOW C.2: 113, West Regent Street

E.R. 6.9.35.

The
Electrical Review

VOL. CXVII. SEPTEMBER 6, 1935. No. 3015.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY. Price 6d.

THE ELECTRICAL REVIEW, DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1.

Telegraphic Address: "AGEKKAY, SEDIST, LONDON." Code, A B C. Telephone No.: Hop 3333 (50 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades and has by far the largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d. Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW, LTD., and crossed "Lloyds Bank."

Index to Advertisers—See page xi.

Principal Contents:

	PAGE
Ten Years' Work	297
Progress in the Home Counties	300
Electrical Development in Brussels. By W. E. Swale	301
Contractors and Wiring Rules. By F. Peake Sexton	303
Klip Generating Station. By E. C. Klopper	304
Colour-lighting a Blackpool Ballroom	305
Lightning Protection. By W. Robinson	306
Revising Motor Ratings. By "Designer"	307
Consumption Analysis. By G. W. Stubbings	308
Correspondence: The I.E.E. Regulations; Electrode Water-heating; The Organisation of Commercial Staffs; The Calculation of Meter Errors; "Let's All go All-electric!"; Turbine Reliability	309
New Apparatus and Devices	311
Laying 33-kV Submarine Cable at Barnstaple	312
Further Lamp Campaign Material	313
New Books	314
Business and Industrial Notes	315
Electric Supply	318
Traction and Communications	320
Contract Information	321
Notes	322
Our Personal Column	323
Financial Section	324
Patent Specifications	327
New Work for Contractors	328

Ten Years' Work

THE London and Home Counties Joint Electricity Authority has now been in existence for ten years and so this is an opportune time to examine its operations and endeavour to see whether its formation has been justified.

The Authority's position is a peculiar one. In one respect it is like an heir to a fortune who is compelled to earn a living until his expectations are realised. That is to say it does not come into its full powers of ownership for many years; in 1971 (unless anything untoward crops up before then) it acquires possession of the London companies. In the meantime it is earning its bread and butter by carrying on a series of small undertakings in the outlying parts of its area and in this business it has been doing very well, both for itself and its customers.

The former owners of these undertakings due, no doubt, to the insecurity of their tenure, were not among the pioneers of cheap electricity. As the first object of the Authority's constitution is to provide a cheap and abundant supply of electricity in its area this matter was promptly taken in hand and to-day the consumers connected to its systems, which are in mainly residential areas, have reason to be grateful. By instituting two-part tariffs, assisted wiring, and hire and hire-purchase schemes the Authority has made electricity available to the poorest people in the districts which it serves and is building up a substantial domestic load. It is also bringing about uniformity in the supply and tariffs.

The undertakings which the Authority operates were taken over during the years 1931 and 1932 and at July 1st in the latter year the number of consumers was 51,348. At May 31st last, less than three years later, the total had risen to 94,041, an increase of almost 84 per cent.

The latest information from the Authority is to the effect that at July 31st last it had 11,604 cookers on hire, but there must be many more in the possession of consumers so that the proportion of cookers to consumers is a very good one. As regards other appliances we show in the article on page 300 of this issue that during the last two years about 1,200 water-heating appliances and 1,700 wash-boilers have been hired out, apart from other smaller appliances.

A great deal of this progress is attributable to an active sales policy. The Authority's travelling showroom is a familiar sight to the people living in its areas, while in each of its districts a showroom is maintained. Pictures of some of these appeared in a recent issue.

Above all a live canvassing staff of twelve has been employed for about a year now. These are unhampered in their efforts by having to attend to consumers' complaints and confine their attention entirely to new business. Consumers' worries are promptly attended to by a staff equipped with three-wheeled motor runabouts.

We think that the figures and facts which we give in our article prove that the Authority has thoroughly justified its existence and will continue to do so.

Lightning

THE thunderstorms that have occurred during the past couple of weeks in various parts of the country have been destructive. The unkindest stroke of all was that which, according to the daily papers, damaged the transformers in the East Kirby sub-station of the Derby and Notts Power Co. Practice in the protection of buildings from lightning, as well as understanding of the fundamental principles involved, has made appreciable progress during recent years, the use of the metal framework of ferro-concrete buildings being an interesting development. But adequate and economic protection is obtainable only under expert guidance, as Mr. W. Robinson shows in his article in this issue. Just as important is proper maintenance. The effectiveness of an earth connection depends upon fluctuating conditions of soil, which, combined with corrosion or damage to the terminal or underground connections, tends to destroy the value of the whole

system. The general adoption of annual testing of lightning conductor earths would, in itself, constitute an advance of possibly even greater significance than the technical progress that has been achieved.

A Belgian Study

IN the course of an examination of electricity supply matters in Brussels Mr. W. E. Swale (who records his findings in this issue) noticed that the dead hand of gas was pressed down pretty heavily. The futility of trying to run the two services in double harness is well exemplified in the Belgian capital. It stands to reason that an established concern like the gas industry will take an interest in electricity only to see that it behaves itself and does not encroach too far upon the gas preserves. Such tactics have been tried in this country and have always proved detrimental to the "junior partner." Generally speaking Brussels has not much to teach us in the way of electrical development but this is not to say that it is entirely without points which it might pay us to study. For instance, Mr. Swale was impressed by some of the publicity material employed, possessing the lighter (not frothy) touch which our own propaganda rather sadly lacks. Again the hiring out of water heaters at a monthly rental *including* the cost of energy is an interesting experiment which might be tried here.

More Generating Plant

THE 110,000 kW of generating plant for the installation of which the Central Electricity Board is reported to have issued directions is presumably a second instalment of the aggregate of 650,000 kW to be ordered this year. We gave particulars of the initial 471,000 kW on July 12th. The present proposal is that Liverpool shall have a 50,000 kW turbo-alternator and Norwich and Portsmouth a 30,000 kW turbo-alternator each. The first two are to install boilers of equivalent capacity, but Portsmouth only two 120,000 lb. per hour boilers. The capital expenditure per effective kW will be just over £14 which, though higher than the average for the earlier directions seems reasonable in the circumstances. The new set at Portsmouth in addition to meeting the requirements of the area in the winter of 1937-38 should appreciably improve the thermal performance of this station.

Selling Light

IT is not the practice of lamp manufacturers to hide their lights under bushels, and once again the approaching end of summer sees them making fresh efforts to persuade the public to buy more light. Some very attractive material to brighten the windows and counters of retailers has been made available, as will be gathered from the brief surveys which have appeared in recent issues. Many familiar figures reappear—the "Mazda" Dancing Girl, the Siemens "Popular Pair" and "Colonel Chris Elco," for instance—while some new ones, such as Philip's "Professor Photometer" make their début. There is still, even in 1935, great scope for increased and improved illumination and in this direction the educational work carried out by the Lighting Service Bureau is of great value. Those concerned with lamps and lighting who have not attended one of the Bureau's illumination design courses should make an effort to do so. They will then be able to talk to customers armed with authentic, interesting and convincing information. The next course will commence on October 14th.

Detecting Underground Water

VERY little information has hitherto been available regarding electrical methods of ascertaining the character of underground formations. The investigations carried out by Professor A. H. Cox and his associates, at the instance of the Department of Scientific and Industrial Research, have met with some success in obtaining reasonably reliable indications with depth-resistivity tests as to the whereabouts of changes in the nature of strata less than 100 ft. below the surface. The results should be of value in the mapping of drift-covered areas where the strata are not too steeply inclined and the surface deposits are fairly homogenous. The major problem of detecting with certainty the positions and extent of water-logged areas in mining districts has not yet been solved, but the indications of the ultimate success of the geo-electric method seem promising. In view of the need both for safety and economy in the working of mines, it is to be hoped that the investigations will be followed up by others based upon the experience gained.

Compulsion Again

THE subject of a compulsory code of wiring rules came up again at a recent meeting of the E.C.A. Council, when the Director reported that representatives of the Association and the I.M.E.A. had conferred with the Terms of Reference Committee of the Institution of Electrical Engineers upon the matter. A majority of the committee were in favour of "exploring" the matter and (according to a report in the *Electrical Contractor*) the I.M.E.A. representative said that "if the E.C.A. would bind its members to carry out work to an approved (voluntary) code the I.M.E.A. would only connect up installations complying with such a code." This seems to be going well beyond the powers conferred upon supply undertakings by the Electricity Acts and the Electricity Commissioners' Regulations, 1934.

Load Factor and Efficiency

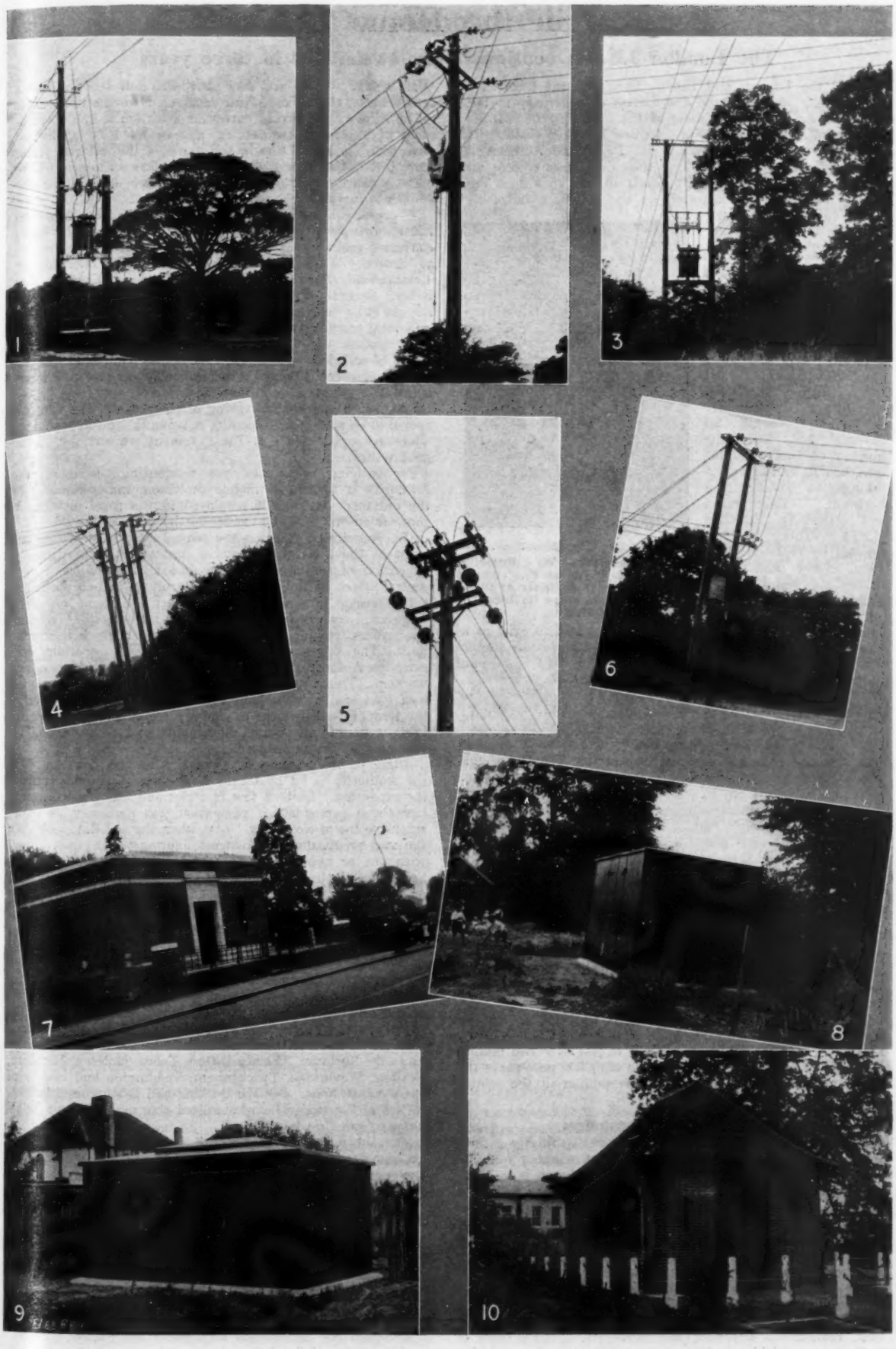
THE importance of load factor in relation to thermal efficiency is emphasised by Mr. H. S. Herbert in our "Correspondence" section. The general truth of the comparison is not affected by an apparent misinterpretation of our illustrative reference last week to the output of the Manchester turbo-alternator, which was that generated since it was put into commission. Thermal values have, however, this bearing on the subject: that unless electricity is generated by sets that require the fewest heat units to produce a kWh, long-hour consumers will not be obtained. The margin between cost of production and price obtainable for loads likely to affect the situation materially is so small that every fraction of a penny reduction in the cost of recurrent expenditure, such as that on coal, may be enough to tip the scales in electricity's favour.

Noise Measurement

THE main obstacle to the reduction of the intensity of undesirable sounds is stated in the first annual report of the Anti-Noise League to be that no simple universally accepted instrument for ascertaining their values exists that is reliable outside a laboratory. As we see it, the prime difficulty is that, in practice, loudness is more of a physical sensation than a physical quantity. We would suggest as a field for fruitful investigation the methods proposed by Messrs. B. G. Churcher, A. J. King and H. Davies in the paper which they read before the Institution of Electrical Engineers on March 8th of last year. This we regard as a definite contribution towards reconciling the engineering decibel scale with the average listener's impression of noise.

Fair Trading

THE Fair Trading Council's activities are still proceeding and the prospects of getting the Policy into operation are considered bright. The Policy has been revised and fourteen schedules have been prepared, only three of which have not yet been formally approved. The support of the municipal supply authorities has been secured and negotiations are proceeding with the power companies to obtain their adherence to the Policy. We are informed that it is the Council's earnest desire to put the scheme into operation early in the New Year.



Typical examples of the London J.E.A.'s overhead line and sub-station work. **(See next page)**

1. 25-kVA B.E.T. transformer, with S. & E. pull-down switch-fuse. 2. Metrovick automatic reclosing pole-mounted circuit-breaker. 3. 50-kVA English Electric pole-mounted sub-station with pull-down switch-fuse. 4. Four-member pole with three-way switching. 5. Air-break section switch. 6. 25-kVA B.E.T. transformer and J. & P. lift-out fuse isolator. 7. Portsmouth Road, Surbiton, sub-station. 8. G.E.C. transformer kiosk, near Hampton. 9. The Authority's largest kiosk (Foster), Hinchley Wood. 10. Brick sub-station, near Dorking

Progress in the Home Counties

The London J.E.A.'s consumers almost doubled in three years

SINCE the London and Home Counties Joint Electricity Authority took over the distribution of electricity in the Middlesex and Surrey areas at the beginning of 1931 its progress, in all branches of its activities, has been little short of phenomenal. Mr. Frederick W. Purse, the Authority's chief engineer, and his staff have their own ideas of how an electricity undertaking should be built up, and that these are justified is amply demonstrated by the statistics and facts below, which have been obtained from recent tours of the Authority's supply area.

[*Elec. Rev.* photo

Mr. Frederick W. Purse, M.I.E.E., M.I.Mech.E., who has been chief engineer of the London J.E.A. since its inception

As the Authority's territory is almost entirely a residential one it is to the domestic side of the undertaking that we naturally look for the greatest expansion. When the L.J.E.A. first started operating as an electricity supply undertaking on January 1st, 1931, the number of consumers bequeathed it by the undertakings at Twickenham, Surbiton, Leatherhead and Dorking totalled 17,893. This number, assisted by reinforcements from Esher and Weybridge six months later, had increased to 29,304 by July 1st, 1932, at which date the Sutton and district undertaking ceased to exist as a separate entity and added a further 22,044 consumers to the total, making 51,348. By the end of July, 1935, less than three years later, the Authority could boast no fewer than 96,457 consumers, an increase of nearly 89 per cent. At the time of the transfer the maximum load was about 9,000 kW: to-day it is nearly 30,000 kW.

A practice which has undoubtedly done much towards popularising electricity has been the simplification and standardisation of tariffs. The supply area, which covers 190 sq. miles, has been divided up into an inner and an outer zone, consumers in the latter paying a slightly higher rate for their electricity on account of the greater distribution costs. Since 1931 the satisfactory state of the Authority's finances has allowed it to make three substantial reductions in its charges, and the present lighting flat rate is 5d. and 6d. per kWh in the inner and outer zones respectively, the domestic two-part tariff comprising a fixed charge based on the size of the premises supplied and a "unit" charge of ½d. in the summer and ¾d. in the winter in the inner zone and ¾d. and 1d. in the outer zone. Almost exactly half of the consumers are availing themselves of the two-part tariff. Since the Authority took over, approximately 13,000 assisted wiring installations have been carried out.

Another idea of the growth of the undertaking can be obtained from the fact that, while at the end of March, 1931, the kWh output to feeders amounted to just over two million a month, the figure (including Sutton supplies) now nears the seven million mark, and exceeds ten million in the winter months.

Attracting New Consumers

In its efforts to attract new consumers the Authority is finding the twelve canvassers which it took on about a year ago of considerable value. The sole duty of these men is to break entirely fresh ground and they are not expected to follow up their "prospects." Builders are their particular mark, and they are sent only where mains already exist. In addition, two development engineers are busily engaged in searching out every prospective building and so pave the way for the adoption of electricity.

Considerable activity has been taking place in the hiring out of domestic appliances, and the Cooker Hire Department is justly proud of the fact that in the period Jan. 1st, 1931-July 31st, 1935, it has secured 11,604 customers. Three types of cooker are available at charges (including cost of installation and 40 ft. of wiring and maintenance) of 4s., 5s. and 10s., according to size. To deal with this rapid growth of hire business a special cooker cleaning and repair depôt to recondition the whole of the apparatus supplied by the Authority is about to be erected on a site behind the showrooms in Ewell High Street. On the first floor above this new depôt will be a central meter testing and repair department for the whole area.

The Authority is giving particular attention to the development of electric water heating, and nearly 1,200 appliances have been let out on hire in the course of the last two years. During the same period approximately 1,700 wash-boilers have been installed and there is a still greater demand for the smaller apparatus, such as irons and kettles.

Wherever prospective business justifies the expenditure electrical showrooms are opened, existing premises usually being converted and utilised. At present eleven are in existence—at Sutton, Wallington, Carshalton, Ewell, Twickenham, Leatherhead, Surbiton, Weybridge, Dorking, Cobham and Esher. Several of these were illustrated in our issue of August 9th. So essential have all the showrooms proved that in several cases extensions are already either in hand or under consideration. At Esher accommodation which was thought would be sufficient for ten years has not been enough for three, and enlargement is being carried out to double the space available. The premises in Sutton High Street, too, have proved far too small and are now being reconstructed. They are expected to be ready for re-opening this month, and in the meanwhile temporary offices at The Pavement are carrying on the good work.

For outlying areas not yet warranting showrooms the Authority is finding its mobile showroom indispensable. In the ordinary way this is employed in the rural districts in summer and on building estates in the winter.

The pressure of space on the central administrative department at the Twickenham offices consequent on the general expansion of business has necessitated the erection of new central offices in Hollyfield Road, Surbiton. When opened in a few weeks' time these will take over the stores, accounts, wages and costing for the whole area, leaving the Twickenham offices free for the original purpose for which they were built. The wages section is now quite an important one, since the Authority has about 1,346 employés, including casual workers. This number does not include the members of the staff paid monthly, totalling approximately 200. Incidentally, the terms of employment of staff are regulated by the various District Board and Council agreements, and a superannuation scheme has been introduced.

Although its business is primarily in the domestic field the Authority is by no means neglecting other opportunities for expansion. Quite a few factories and industrial concerns have been persuaded, if persuasion was necessary, to make extensive use of electricity. Also when the L.J.E.A. took over the area practically all the street lighting was by gas. Now, with one or two unimportant exceptions, the whole area is lighted by electricity, over 9,000 lamps having been converted or installed.

Distribution Arrangements

Naturally all this intensive development has involved considerable work on the distribution side. Practically the whole of the Authority's electrical requirements are now received in bulk directly or indirectly from the Central Electricity Board, the Kingston and Twickenham generating stations being retained only for standby purposes. A bulk supply from the grid is taken at a pressure of 33 kV at the Kingston grid substation, where it is transformed to 11 kV before being passed on to the Surbiton, Thames Ditton, Esher, Molesey, Hersham, Walton, Weybridge, Twickenham, Teddington and Richmond main sub-stations. For the Dorking and Leatherhead districts a Central Electricity Board overhead ring main brings a 33-kV supply from Croydon.

The sub-station in Portsmouth Road, Surbiton, now plays an important part in the general scheme and controls and meters the whole of the supplies radiating from it to the south and west of it. Fed by four feeders from Kingston, it has three feeders serving Esher and two serving Surbiton. For the metering Ferranti summation equipment has just been installed.

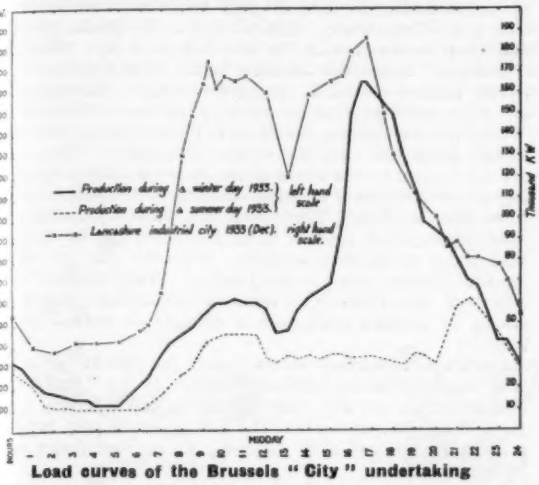
The supply for Sutton and district is obtained from the Beddington sub-station of the C.E.B. and transmitted to the Authority at 11 kV *via* the County of London Electric Supply Co., Ltd., at its Beddington sub-station, from which point the Authority takes the supply to its principal sub-station at Carshalton for distribution throughout the Sutton district.

Almost the whole of the e.h.p. supply is received at the sub-stations at 11 kV, there being a small exception at Leatherhead where a part of the supply is still at 3,500 V. In the erection of sub-stations and transformer kiosks, of which, incidentally, 29 and 130 respectively have been completed since the Authority took over, particular attention has been paid

Electrical Development in Brussels

By W. E. Swale, A.M.Inst.C.E., A.M.I.E.E.

IN the streets of Brussels those gay little green taxis, flaunting their twin pennants: "For Tuborg and St. Michel" (a clever advertising trick, this!)—in the Pavilion of Domestic Electricity at the Exhibition the subtle electrical slogan: "Nettoyer c'est bien; ne pas salir c'est mieux"


Production during a winter day 1935. left hand scale
Production during a summer day 1935.
Lancashire industrial city 1933 (Dec). right hand scale.
Thousand KW
MIDDAY

Load curves of the Brussels "City" undertaking

(Cleaning is good; but why get dirty?)—such things arrest the attention and make one think: "Here is a nation of psychologists. Their methods of sales propaganda should be interesting." But this is anticipating our story.

In Belgium economic expansion is evident on all sides; striking modern buildings, the two tunnels under the Scheldt, the new electric railway from Antwerp to Brussels, the vast Exhibition itself, all speak of notable development and faith in the future. It can only be regarded as a minor tragedy that the I.E.E. summer visit was crowded out—presumably by "conventional" activities at home. Our busy week in June will leave many happy memories; the electrical people we met were charming and helpful, and if the primary object of the visit, the Exhibition itself, was crowded into a single hectic day, we can truthfully blame the electricity supply conditions which rival London's chaos, and make a rapid survey a matter of unexpected difficulty.

In Belgium—the most densely populated country in the world (over 790 inhabitants to the square mile)—a total usage of 463 kWh per head indicates no mean stage of electrical development. Yet in 1933 the sales in the two largest "boroughs" of Brussels (the Ville de Bruxelles area and Schaerbeck) were little over 100 kWh per head. How can one reconcile these facts?

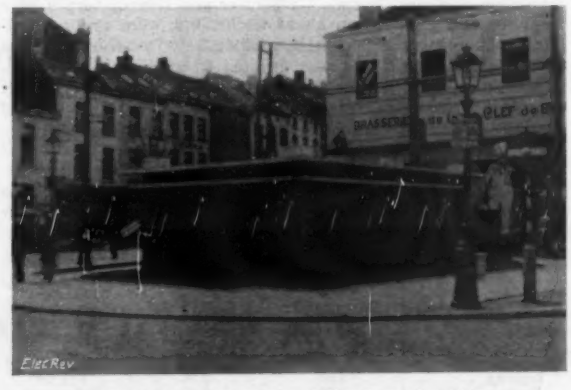
Retail prices are not markedly different from ours—coal at power station 16s. 2d. per ton, Belgian household anthracite averaging 2s. per cwt., household coke cheap at 1s. 6d. per cwt. Domestic gas, on the flat rate, averages 3s. 11d. per 1,000 cu. ft.

The reasons for the low average sales were, we concluded, mainly that the city has no heavy industries; the traditional slow combustion stoves for building warming and cooking render the burning of raw coal reasonably efficient (incidentally, this enlightened Continental practice does result in cleaner cities); company-owned gas competition is deep-rooted; and the "City Fathers" still think in terms of small sales and gilt-edged returns.

In 1933 over 61 per cent. of the energy sold in Brussels "City" was for lighting, the yield, for low-voltage d.c. supplies, averaging 3.19d. per kWh. Greater Brussels (the aptly named "agglomération bruxelloise") with a population of 866,000 covers about 20 square miles, and is divided into fifteen self-governing "communes." The city's needs for electricity conform to no recognisable plan, and the result is a medley of tariffs, conditions, and voltages, both d.c. and a.c.

The fine power station of the "City" undertaking, on the Quai des Usines, was the scene of a disastrous fire in 1932. It now has an installed capacity of 50,400 kW, and in 1933 generated 67.5 million kWh at a load factor of 23.3 per cent. Distribution is at 36,000 V for bulk supplies, and for the local network at 5,000 V, through thirteen city sub-stations. These, by the way, now contain nearly twenty mercury-arc rectifiers, ranging in size from 200 kW to 1,250 kW. The sub-station illustrated is interesting by reason of its floor being some 4 ft. below street level. The City undertaking has no electricity showrooms, and the commercial manager, M. Brandenburg, regretted that he had nothing to show us in the way of modern methods of exploitation.

The neighbouring commune of Schaerbeck (about 2½ sq. miles, with 123,000 inhabitants) presented a much more cheerful aspect, from the point of view of sales development, and the commercial manager, M. Hernaldsteens, with his showroom manager, M. Desmaré, were refreshingly optimistic. This municipal undertaking buys in bulk from the Interbrabant Co., and in 1933 distributed nearly 11 million kWh (about 89 kWh per capita). The area is mainly residential,



A new sub-station of the "City" undertaking

and over 90 per cent. of the houses are now connected. It is served by the St. Josse Gas Co., with whom a complex gas-electricity price agreement is maintained. Distribution is effected through 6,600-V sub-stations, spaced 500 to 600 yd. apart, and mainly of only 250-kVA capacity. Low-voltage supplies are given at 190 V three phase, and 110 V single

---

Progress in the Home Counties. *(Continued from preceding page)*

to the individual local authorities' requirements in the matter of design. Steel kiosks are standard for housing the smaller transformers, while brick-built sub-stations designed and built by the Authority's own staff are used in the more important positions when a considerable load has to be dealt with. Examples of the various types of sub-stations employed are illustrated on page 299.

The L.J.E.A. has always had in mind the importance of standardising the apparatus used and also the various systems it inherited, and a great deal of work has been done in this direction. The whole of Surbiton has recently been changed over from d.c. to a.c., and at the present time the a.c. supply in Sutton is being converted from 200 V to the standard 230 V. Even in districts which are still utilising d.c. the policy is, where possible, to deal with any considerable new loads (such as blocks of flats) by looping in e.h.p. feeders and providing local sub-stations supplying standard voltage a.c.

Since January, 1931, it has been found necessary to carry out 808 miles of mains extensions (95 overhead and 713 underground). The overhead lines are almost entirely in the Dorking rural area and no trouble has been spared to make them inconspicuous. An idea of the various types of equipment used can be obtained from the pictures on the preceding page.

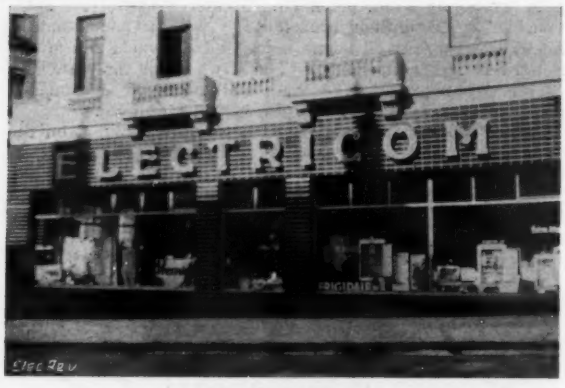
In addition to its duties as an electricity distribution undertaking the Authority also has a considerable amount of work to do in connection with its supervisory control of London's supply undertakings generally under the London Electricity Supply Acts, Nos. 1 and 2, of 1925, in view of the fact that all the London company undertakings become automatically vested in the Authority in 1971.

The Authority under its Orders has a number of important administrative duties, and equally important is the work of arranging for the bulk supply to no fewer than thirteen undertakings in its district, the output exceeding one hundred million kWh with a maximum demand of about 130,000 kW.

The chairman of the Authority is Ald. J. Chuter Ede, J.P., D.L., who is also chairman of the Surrey County Council. The vice-chairman is Ald. Dudley Stuart, ex-Mayor of Wimbledon and ex-chairman of the Wimbledon Corporation Electricity Committee, and at present chairman of Wimbledon Finance Committee. The clerk and solicitor of the Authority is Mr. Leslie Gordon, and the finance officer Mr. A. L. Burnell.

phase. Main thoroughfares are cabled with 4-core 0.108 sq. in. (0.078 sq. in. neutral) and secondary streets with 4-core 0.078 sq. in. (0.054 sq. in. neutral). The introduction of suitable domestic tariffs and the opening of a showroom were recently recognised to be vital factors in domestic development.

A few other communes have municipal distribution undertakings (*e.g.*, St. Gilles, which buys in bulk from the "Ville"), but their sales activities appear to be prosaic. In the southern portion of the agglomération five communes are supplied by the Soc. Anon. "Electrogaz" which also serves,



The Schaerbeek municipal showroom

under the name of the Societé Provinciale du Gaz et de l'Electricité, some forty rural communes, extending far out into Southern Brabant. On learning that this apparently prosperous concern is controlled by the Imperial Continental Gas Association one felt a chilly premonition—which was only too justified by subsequent investigations.

The sales officials at the well-appointed showrooms in the Chaussée d'Ixelles, Messrs. Carpentier and Raucq, very kindly supplied full information about tariffs, but were uncommunicative as regards other sales statistics. Two-thirds of the ample showrooms space was devoted to a representative collection of gas appliances—from the shareholders' point of view no doubt a well-calculated policy of "making the best of both worlds," but for an electrical man a depressing sight.

Tariffs—Logic before Expediency

The art of mystifying the layman, in respect of conditions of supply, has possibly reached an even higher pitch of perfection in Brussels than with us. In one tariff sheet the consumer reads that the maximum current taken by his power meter can be calculated from $P(\text{chevaux vapeur}) = E.I.\sqrt{3}\cos\phi$ (where E = 190 V and $\cos\phi = 0.8$). In a high-voltage agreement he is told that "the reactive energy exceeding three quarters of the active energy ($\tan\phi = 0.75$, $\cos\phi = 0.8$) will be charged at 30 per cent. of the average cost of active energy." Perhaps it pays to "catch 'em young and treat 'em rough"; they may not ask so many questions later.

TYPICAL BRUSSELS TARIFFS (in pence per kWh).

Item.	Brussels City.	Schaerbeek.	Soc. Anon. "Electrogaz" (varying according to communes) average.
Flat rate:			
Lighting	3.36	2.76	5 to 2.6
Power	1.73	1.47	Not quoted
Cooking	None	None	Summer 1.3 / Winter 1.73
Night water heating	None	None	10 p.m. to 6 a.m., 0.7
Simple domestic "all-in" rate.	None	None	Fixed charge based on number of rooms, e.g., for 5 inhabited rooms f.c. = £1 3s. 1d. p.a. + unit charge = ½ of lighting flat rate (min. 1.3d.) (*c*)
Compound domestic rates:			
Bi-horal:			
Peak hours ...	(*a*) 3.36	(*a*) 2.76	
Other hours ...	1.66	1.04	None
Domestic "all-in" ...	Peak hrs. 3.36 (*b*) First 30 hrs. p.m. per kW "Summer" m.d. ... ... 2.42 30 to 60 hrs. p.m. per kW. m.d. ... ... 1.73 All above ... 1.04	*Tri-horal:* Peak hrs. 2.76(*a*) Day hrs. 1.04 Night hrs. 0.87	None

N.B.—Govt. tax has to be added to company bills, viz., 5% for electricity and 2.2% for gas

(*a*) Peak hours = ½ hour before sunset until 1 a.m. (*b*) Peak hours = 4 p.m. to 6.30 p.m. during October to March. (*c*) Equivalent "all-in" tariff for gas supply = £2 3s. 8d. p.a. + 2s. 1d. per 1,000 cu. ft.

A few comments on the foregoing summary will suffice. The assumption underlying the bi-horal tariff is no doubt correct (*viz.*, that *all* loads occurring between half-an-hour before sunset and 1 a.m. must bear some "peak" charges), but the probability of diversity is not taken into account. One consumers' bulletin; "Le Contact" engagingly points out there are only 2,551 hours in the year when the peak price of 2.76d. per kWh is in force. Presumably all cooking and room-heating have to be done before sunset. The Brussels "City" all-in tariff is an improvement in that its peak hours are only from 4 to 6.30 p.m. Incidentally, with all the tariffs quoted there are additional meter rentals. In the case of a 30-A three-phase "tri-horal" meter this amounts to 2s. 2d. per month.

The booklet on tariffs supplied by the "Electrogaz" is an informative publication running to over 11,000 words. Where the key-figures, the flat-rate lighting and power prices should stand one finds the cryptic comment: "These prices are determined by the terms of the contracts, and vary according to the commune, and the economic conditions prevailing from case to case." Even with this company undertaking, sales development appears to be hampered by the lack of a bold policy of mains extensions. How else can one account for the defeatist note, under heading "Tarif cuisine"—"In Etterbeck and Uccle (two suburban communes) energy consumed by cooking appliances is charged at normal lighting rates"!

From the Schaerbeek annual report for 1933-34 one gathers that the undertaking purchased energy at the "bulk" price of £1 18s. 9d. per kW plus 0.456d. per kWh (giving a total price of 0.658d. per kWh). The h.v. power supply tariffs for a 200 kW m.d. and a 20 per cent. annual load factor are as follows:—

Item.	Brussels "City."	Soc. Anon. "Electrogaz."
Fixed charge per kW. of m.d.	£2.715	£3,180
Unit charge per kW., pence	0.436	0.43
Overall price per kWh., pence	0.796	0.949

It is unwise to base a judgment on only the briefest experience of local conditions; but the writer has the impression that the tariff economy is a little unimaginative, and does not cater effectively for the vast potentialities of present-day electrical applications. On the other hand it should be emphasised that practically no competition is experienced from private oil-engine plant.

As regards other "promotional" schemes, hire-purchase and simple-hire terms are offered (except by the "City" undertaking). Assisted and prepayment wiring schemes are apparently unknown.

Domestic Electrical Appliances

The general standard of design and finish of several lines of domestic appliances (notably those of Nestor-Martin, and Vesta—both Brussels firms, and of the international S.E.M.) indicate a high order of manufacturing resources. Electric cookers, entirely of pressed steel, have pleasing lines. The general absence of the grill enables three hot-plates to be fitted. Solid hot-plates are universally used, and the British "Chromalox" element is much in evidence. Nearly all cookers have the tops extended sideways, giving more space for cooking utensils.

A popular Nestor-Martin model has three hotplates of 8.7 in., 7.1 in., and 5.5 in. diameter rated at 1,800 W, 1,200 W, and 800 W respectively. The oven space is 31½ in. wide by 31½ in. high by 22 in. deep, with top and bottom elements of 1,200 W and 1,600 W. The list price (white enamelled with heavy-duty switches) is £16 10s. Notable features of the cookers are the drop-down oven doors, absence of plate racks, absence of kettle plugs, and, most remarkable, absence of thermometers. Cooking is done entirely on a time basis. Can it be that our much prized oven thermometer is really only a fetish?

Other appliances follow conventional designs, though the choice of electric radiators is very limited, and their appearance lacks "allure." Small table cooking appliances are plentiful, and good in construction, but some of the associated flexibles and plug-in contacts looked dangerous. Refrigerators and vacuum cleaners by several international firms made a good showing. Water-heaters of the usual design are in evidence, and it is interesting to note that the "Electrogaz" hires these out at a monthly rental (*e.g.*, a 3.3-gall. heater for 7s. 2d. per month) *including* the cost of energy, which is metered separately, and deducted from the general account.

Special mention deserves to be made of the new Schaerbeek showroom (opened early in 1935) which, as the photograph shows, has a pleasing exterior. It has a very comprehensive selection of domestic appliances, ranging from superbly decorative mains clocks to the latest in washing machines, and

hydro extractors. The last, indeed, priced at only £7 5s. with a consumption of 1/10 kWh per trip, and large enough to take about 12 lb. dry weight of washing, was the first machine of its kind we had seen. The appliances shown are lent by the respective manufacturers on a sale or return basis. Registered contractors assist in canvassing for new business, and share the discount with the supply authority. Frequent cookery lectures are given by manufacturers' representatives.

The Exhibition and Propaganda Methods

Of the 20,000-kVA of transformer plant installed at the Exhibition, the remarkable reinforced concrete Grand Palais, with its lovely show of locomotives, of the exquisite illuminations at night, of the much criticised British Pavilion, and the good food at Old Brussels, one would like to write a lot more. A few words about the Pavilion of Domestic Electricity must suffice. The wise first fortified themselves with a luncheon cooked in an all-electric kitchen.

The exhibits were good, though not comparable in range with those seen at our Ideal Home Exhibitions. Some notable commercial cooking apparatus was shown; but certain domestic appliances (*e.g.*, washing machines with unguarded belt drives) did not equal our manufactures. From this show, as elsewhere, one gathered that floor space is rather more generous in Belgian kitchens, so that extreme compactness of design is not so essential. The hall was most tastefully laid out, and gained in effect by not being overcrowded. An interesting feature was a series of working models illustrating fatigue tests on such parts as domestic flexibles, plug-contacts, &c.

A word must be said, finally, about the high quality of some of the electrical publicity matter which we collected in the city. Poster advertising appears to be non-existent (though the injunction "Use Gas!" arrested the eye at every turn), but certain printed matter is outstandingly good. The "Electrogaz" issues, at a subscription rate of only 5d. per annum, a monthly broadsheet entitled "Miss Watt ventures to suggest. . . ." In this two-colour leaflet advice on tariffs, testimonials, household hints, and especially cookery recipes, are set down with marked advertising skill. The star effort in publicity, however, is certainly due to what may be called the Belgian E.D.A. (the full title is too long to print). Their "Comité d'Etudes Techniques" publishes, bi-monthly, a 12-page bulletin called *Le Confort chez soi*. This contains semi-technical articles on electrical housecraft and cookery recipes, written in a thoroughly authoritative style, but enlivened with photographs of consumers' installations, artistic wood-cuts, and most appealing little sketches. The C.E.T. deserves to be very warmly congratulated on this series.

A cordial word of thanks is due to the courteous gentlemen named in these notes, who cheerfully and frankly discussed their problems. Whilst electric cooking was all but unknown in Belgium three years ago, they would probably consider gas lighting in a private house a woeful anachronism. Development has proceeded on different lines from ours, but a study of their methods was none the less of great interest.

Pommes de terre sautées *Rôti de veau* *Poulet rôti*

Deft touches in domestic publicity (From *Le Confort chez soi*)

Contractors and Wiring Rules. By F. Peake Sexton, A.R.C.S.

A simple explanation of the new amendments

IN the supplement to the tenth edition of the Wiring Regulations just issued by the Institution of Electrical Engineers the continual reference to the original publication makes reading both tedious and difficult. Many of the regulations could no doubt have been expressed in clearer and more precise language, but official documents have to be written in a semi-legal style to avoid disputes that might arise over a freer version. Then again in many cases abbreviation has been practised.

The following review of the amendments may be useful to contractors and save them time and brain-fag.

Final Sub-Circuit.—The new definition includes two circuits that are looped into the same pair of fuse ways. This seems contrary to common sense and is difficult to justify, except that it saves re-wording one or more regulations.

Regulation 4.—This regulation has been much cut up and sections D, E, F added. This seems to be mainly a question of arrangement, but a great concession has been made by allowing an increase of 140 per cent. in load above the carrying capacity of the cables, where this is justified by the diversity factor.

Regulation 112.—The note to clause C has been revised making it clearer that all switches, &c., must be in the non-earthed side or wire.

Regulation 201.—A note has been added to clause C which allows a change in area of a conductor, if protected at the point of change by a fuse or circuit-breaker. This can be omitted if the fuse or circuit-breaker on the larger cable is set low enough to protect the smaller cable. Clause F, which allowed a 2-A plug to be counted as a lighting point, has been deleted, and a new clause inserted which assumes a load of ½ A for each point fitted.

Regulation 210.—This has been redrafted making it clear that a d.p. fuse must be used in the secondary circuit of every bell transformer when necessary. The introduction of "*necessary*" was surely undesirable, as it gives too much scope to the contractor and may cause friction between him and the supply company. The size of the fuse is not specified, but previously it was 3 A—a value that was well above the short-circuit current of many bell transformers.

Regulation 310.—The preamble has been amended so that the colour scheme is not compulsory for d.c. circuits, but if different colours are used they must be in accordance with the clauses of this regulation. The result will surely be that much three-wire work will be done in unicolour.

Regulation 311.—This is a repetition of 310 (which see) but for a.c. systems. In notes added after sections D and F permission is given to use parti-colour (red, white or natural) instead of green, for impregnated paper cables.

Regulation 312.—It is now permissible to omit cable lugs "if substantial mechanical clamps" are provided. Here some contractors may differ as to what is "substantial"; for instance, is a porcelain connector substantial?

Regulation 402.—Note to section E. Bare-copper and lightly insulated conductors may be installed in a battery room if the latter is "adequately ventilated."

Regulation 408D.—It had been assumed by many that Regulation 408 prohibited the use of ventilated conduits, but it is now made clear by an addition to this regulation that ventilation is permitted. It points out that the vents must be suitably placed, and certainly too much care cannot be taken on this point.

Regulation 604.—This maintains that the connection between flexible cords and cables shall be made by suitable

mechanical connectors. It has now been modified by allowing (subject to Regulation 606) the use of a lampholder plug, better known as an adaptor.

Regulation 607L.—This has been deleted. The original clause forbade the connection of, say, a 15-A plug top to an appliance consuming only 5 A. I am using a redundant word in "plug top," but want to be clear as even now many contractors apply the word "plug" to a socket.

Regulation 609B.—An addition to clause B has been made specifying that in the case of walls composed of combustible materials the case or cover of the switch shall be of rigid metal or incombustible material, and if metal conduits are used a metal case must be provided.

Regulation 710 has been entirely redrafted in three sections. A prohibits the connection of an auto-transformer to mains above 250 V, unless used adjacent to a condenser for either power-factor correction or electric discharge tubes below 500 V. B says that an auto-transformer must not be used for supplying power to a portable appliance, unless it be on a private plant with earthed neutral at low or extra low voltage. C stipulates that a step-up auto-transformer shall not be connected to an installation obtaining its supply from a system in which none of the supply mains is connected to earth.

Regulation 713.—By an addition to this regulation it is now permissible to connect an electric clock without the need for control by a switch, provided the connection is made in accordance with Regulation 202.

Regulation 801.—Electric discharge signs must now be in accordance with British Standard Specification 559. Contractors should therefore specify this in buying these signs.

Regulation 810B.—The prohibition of metal conduits for the protection of cables supplying electric discharge signs is now withdrawn. Lengths of conduit must, however, be unjointed and earthed.

Regulation 1005.—A note added to clause B states that:—"The test specified in Regulation 1110 need not be made when there is good reason to believe that the above value of resistance is not exceeded." The value here referred to is 1 ohm. This test has never to my knowledge been made by a contractor since the tenth edition came into force, and under this regulation (1005) will now be still omitted perhaps without the "good reason."

Regulation 1007A.—It is now made clear that the earthing lead may be either stranded or solid. (Minimum area 0.0045 sq. in.). A substantial mechanical clamp may be used in place of a soldering socket on an earth lead.

Regulation 1323.—I. This clause has been redrafted. It is here specified that in a portable fitting a lampholder shall be efficiently:—(1) insulated from the fitting, and (2) shielded by insulating material to prevent its being touched by a person using the fitting. The glass shade or bowl must not be considered as an insulating shield. J. This clause which was concerned with the construction of hand lamps has now been withdrawn.

Regulation 1332.—This regulation, which specifies the requirements for the adjustment of circuit-breakers, is now only to apply to those rated at over 15 A. It is therefore now permissible to replace fuse-boards by simple circuit-breakers up to and including a rating of 15 A.

Every contractor or reader interested in this note is strongly advised to get the official publication of the Institution of Electrical Engineers as approved by the Council on June 20th, 1935. This is issued free to those possessing a copy of the tenth edition.

Klip Generating Station. By E. C. Klopper

Progress of a 350,000-kW South African scheme

THE great expansion that has taken place in the Witwatersrand gold-mining industry since 1932 has led to the construction of the Klip generating station on a 350-acre site five miles from Vereeniging. Work was begun in July, 1934, and the first installation of 132,000 kW is expected to be ready for service early next year. The Klip station and its associated transmission and distribution systems are being built for the Electricity Supply Commission by the Victoria Falls and Transvaal Power Co., Ltd., which will operate the station, taking the whole output of 800 million kWh per annum (*i.e.*, of the first section) from the Electricity Supply Commission at cost price.

Water will be conveyed from the Vaal River by pipe lines to ponds at the bases of the cooling towers. About six-and-a-half million gallons per day will be required when the station reaches its ultimate capacity of 350,000 kW. Coal will be obtained from an adjoining colliery and will be passed direct from the pithead through crushing and screening plant to the station bunkers.

The Vaal River, near Vereeniging. Water is being conveyed from this river by pipe lines to ponds at the bases of the Klip station cooling towers

Eight Babcock & Wilcox boilers with normal outputs of 180,000 lb. per hour are being erected. Steam conditions will be 355 lb. per sq. in. and 760 deg. F. The economiser will be supplied with water at 250 deg. F. The chain grate stokers, measuring 33 ft. wide by 20 ft. deep, are said to be the largest in the world. Air will enter the air-heater at 95 deg. F. and be delivered beneath the gates at between 250 and 285 deg. Two forced-draught fans, two secondary-air fans and one induced-draught fan, with grit extraction plant, are to be installed per boiler. Each boiler will have its own steel chimney 240 ft. above the firing floor. Ash will be removed hydraulically to two sumps, from which it will be delivered to an overhead bunker by a grab and telpher.

The three electrically-driven and two Weir steam-turbine feed pumps will have individual duties of 45,000 gal. per hour, at 475 lb. per sq. in. and 200 deg. F. Coal conveyor equipment comprises one inclined belt and one shuttle belt, with capacities of 275 tons per hour, at 300 ft. per min. The four 33,000-kW (economic rating), 3,000 r.p.m. Met-Vick turbines will be bled at three points for supplying steam to an evaporator and h.p. and l.p. feed heaters. The alternator stators are wound for 10.5 kV. A 7,000-kW house service set is also being erected.

Contra-flow condensers are being employed with three air-ejectors in series and a closed condensate system. A turbine-type water extraction pump will deal with the whole condensate of each unit.

In addition to the unit evaporators, a Hick-Hargreaves triple-effect central evaporating plant will be employed with a continuous output of 25,000 lb. of make-up water per hour.

For stepping up the generator voltage to the transmission voltage of 88 kV, four 40,000-kVA Ferranti transformers are being installed. The station auxiliaries will be supplied from two 8,500-kVA, 88/21-kV, two 8,500-kVA, 21/2.25-kV, and two 1,000-kVA, 2.1-kV/400-V transformers of the same make. The last-named will be air-cooled, the others oil-cooled by forced circulation. Two 2.1-kV oil-immersed earthing compensators rated at 500 A for one minute will also be included. A five-motor travelling crane with a span of 97 ft. 8 in. will be installed in the turbine room.

The four cooling towers (220 ft. high and 175 ft. in diameter at base) will each have a capacity of two million gal. per hour. The water will be returned through 10 ft. 6 in. dia. culverts to the circulating pumps at the condensers. Two 26,000-gal. crude-water reservoir tanks are to be constructed.

Colour-lighting a Blackpool Ballroom

A NOTABLE example of what can be achieved in the way of interior colour floodlighting is the Empress Ballroom at the Blackpool Tower Co.'s Winter Gardens, details of which have been sent to us by Mr. K. L. Foster, the works manager.

The ballroom is one of the largest in the country, the actual dance floor being 160 ft. long and 90 ft. wide. The colour-lighting of the floor is done by a series of battens hung along both sides of the room at a height of 35 ft. and rendered inconspicuous by a heavy plaster cornice. In all, they comprise 176 separate compartments, each containing a 500-W gas-filled flood-lamp with a specially designed mirror reflector and colour screen. These compartments are divided into red, green, amber, and blue, and each colour is again split into six main feeder circuits each controlled by its own dimmer plate, switch and fuse, thus keeping the size of the dimmer plates and circuit wiring reasonably low. The lighting of the ceiling is effected by twelve huge cut-glass chandeliers which have been rewired and fitted with coloured lamps.

Along the balconies there are thirty-six ceiling fittings with coloured and clear lamps. In the promenades ceiling fittings have been dispensed with, the plaster casts surrounding the main pillars supporting the balconies being replaced by fittings conforming to the original casts. Twelve large ceiling fittings of a more elaborate design are employed in the lounge.

The stage is treated as a separate subject for lighting and decoration, being illuminated by six colour-lighting battens composed of eight compartments, each compartment containing a 100-W lamp, reflector and colour slide. The music stands, rostrums, front of the stage and proscenium fronts, are also fitted with colour changing apparatus.

The main switchboard (Igranic) provides for automatic control combined with remote control, or manual operation if necessary. The board is in three sections, namely, (1) switch and fuse panels, (2) contactor panel, and (3) push-button panel for the emergency operation of the board and inspection. Built as a separate unit are the four dimmer banks, one for each colour. These are in two sections, one for stage and the other for floor control. The units of the dimmer banks are motor driven, or they can be manually operated collectively or individually as required.

Coupled with the contactor panel in parallel, and situated at the dance floor level, is a remote control push-button panel governing the whole of the ballroom lighting. The positions of the dimmers at any time are shown on the panel by a series of pilot lights, and the open and closed positions of the circuit contactors are indicated in a similar way.

The main supply to the switchboard is brought in by three p.i. cables, two in parallel to feed the colour panel and one to feed the house and independent panel. All cross connections from the main switchboard to the dimmer banks are carried in a specially designed heavy steel wire trough connecting the two units.

There is altogether 120 kW of colour lighting, and three-quarters of this load is in use at one time. The white lighting load amounts to a further 80 kW. All fuses are of the Triumph "P" type, and the switches for circuit control are Dorman & Smith's knife pattern. The contract for supplying the whole of the lighting equipment, *i.e.*, switchboards, dimmers and flood battens, was placed with the Edison Swan Electric Co., Ltd., and that for the cables with Callender's Cable & Construction Co., Ltd.

The Tower Company's Works Department carried out the entire installation without interfering with the nightly programme of dancing. The department also designed and built the ninety lighting fittings for the balconies, promenades and lounges, which were electrically welded and made with a sheet steel backing as a protection against fire, and also rebuilt the stage, music stands and effects.

Despite the fact that the final circuit was coupled only a few minutes before the first performance, the satisfaction that the public seemed to obtain from the novel and varied effects was shared by the engineers concerned, and there were no hitches to mar the event.

Colour-lighting equipment in the Empress Ballroom, Blackpool

1. The north promenade, showing the lighting fittings in the main pillars. 2. Remote-control push-button panel. 3. General view of the ballroom. 4. Motor-driven dimmer banks. 5. Front of the switchboard, and 6, the rear

Queensland Electricity Regulations

The Electrical and Radio Trader (Sydney) says that the new Queensland Electric Light and Power Regulations provide that electricity supply authorities are to be charged fees, based on their output, by the Government to cover the cost of inspecting electrical apparatus and installations. Several accidents through the use of faulty appliances have been the cause of these regulations. The fees are to be assessed every six months and the scale is to be 1/20th of a penny in respect of the first 25,000 kWh sold; 1/40th of a penny in excess of 25,000 up to and including 100,000 kWh, and 1/80th of a penny for all kWh above. At this rate the Brisbane City Council will be called upon to pay £1,600 a year.

Lightning Protection. By W. Robinson, B.Sc.

Methods of meeting modern requirements

BEFORE discussing modern lightning protection from the technical aspect some attention should be given to what is the most pressing question, namely, its economic justification. As far back as 1905 Dr. van Gulik, in a report to the Dutch Academy of Science, said: "The means by which protection is secured and the outlay required depend to a large degree on the value attached to the preservation of a building from damage, large or small." The protection of a building from a contingency regarded as remote involves a large degree of compromise. The two factors that primarily affect the question of a lightning conductor installation are, first, the possibility of a lightning stroke; and secondly, the value attached to the preservation of the building in the event of such a stroke occurring.

The engineer, in estimating for a lightning conductor installation, has to consider, not what it will cost to protect the building properly, but how well the building can be protected within a given cost. Since the monetary allowance for such protection is usually based on a consideration of the two factors above mentioned, while the cost of adequate protection is based on the necessity of dispersing a stroke with no regard to the possibility of such a stroke occurring, it usually falls to the lot of the engineer to relate these scarcely compatible elements.

The lightning-rod men of old are no longer with us, nor is their absence regretted, but fallacies as to the nature of lightning and the function of a lightning conductor still exist. Many people regard a lightning rod as a means of attracting the flash and leading it harmlessly to earth, and believe that a certain height of rod is necessary to protect a given area of building; lightning protection is still being installed by builders and odd-job men consisting of one earthed rod on the highest point of the building optimistically designed to protect the whole building. One of the main difficulties of the specialist in lightning protection is, indeed, the competition of the general builder who, by allowing for a grossly inadequate system of conductors, will budget less for this item than will the expert.

A further bias against protection is due to the inclusion by insurance companies of all lightning risks in general fire policies. To the public this conveys two things: first, that they have not to fear the monetary loss associated with a harmful lightning stroke, and secondly, that the insurance companies do not regard the chances of damage by lightning as worth serious consideration. There is thereby fostered in the mind of the householder a psychological reaction against the expense incurred.

The requirements of a lightning conductor installation are, then, that it shall involve no more expense than is deemed justifiable by the value attached to the preservation of the building from damage, that it shall offer the maximum protection from both direct and dispersive strokes, that it shall be as inconspicuous as possible, and that it shall withstand all deleterious effects of time and weather without the need of frequent attention to the exposed parts.

Recent Developments

Modern advances in the science lie mainly in the provision of definite schemes of conductors, interconnected to form a network round the building and designed to make the utmost use of existing metal on it so that a stroke on any part of the building is led, by one or more paths, to earth. This principle of using metal incorporated in the building for its protection has led, in the case of at least one notable public building, the London County Hall, to the complete elimination of external conductors. As this building is of steel framework construction, it was considered necessary only to dispose terminals over the roof and to bond these to the girder framework, and to earth the girder system. This constitutes an admirable scheme if it is ensured that the steelwork is well interconnected and earthed, and there is little doubt that such a scheme will prove advantageous for factories and steel-frame buildings in general by its efficiency, economy and unobtrusiveness.

The protection of a modern building is not, nowadays, merely a question of the external topography of the building, but is complicated by the existence of earthed metal inside the building, such as electrical conduits, motors, &c., which offer alternative paths to earth. If these bodies occur near the conductor down line it may happen that their earth resistance is comparable with, or lower than, that of the conductor, with the result that the down flash may leave the conductor and choose a path to ground via the interior earthed metal, with disastrous effects. It is, therefore, present day practice to bond all interior earthed bodies to the lightning conductor if not more than six feet distant. Similarly, large bodies of earthed metals collect a static charge from the atmosphere even if a lightning discharge is some distance from it. Sparking between these and earthed bodies may occur, with danger of fire, unless all such bodies are bonded to one another and to earth. This is of especial importance in buildings containing explosive or inflammable materials.

Importance of Good Earthing

The efficiency of any system of conductors can never be more than a function of the efficiency of its earthing. The earth is of paramount importance, and for lightning protection the requirements are somewhat different from those of, say, a wiring installation. The object of earthing a wiring installation is to ensure that even a small fault will cause a sufficiently large earth current to operate the protective gear, and for this purpose a low earth resistance is the criterion. In lightning protection, however, the object of the earthing is to disperse, without any disruptive effect, an instantaneous and very heavy current rush. Thus, although the commonly accepted British standard for lightning protection lays down that the earth resistance shall not exceed ten ohms, the question is, perhaps, more suitably dealt with under American rules which provide that the earthing shall consist of metallic masses laid in the earth of such size and disposition that the heavy rush of current shall be able to be dispersed safely, *i.e.*, without any explosive effect.

To put this in another way, the question of the earth resistance of a lightning conductor, while being important, should not be allowed to overshadow the necessity of ensuring that the potential gradient does not reach a dangerous value, an event which could occur even with a very low earth resistance if the earth terminal presented an insufficient sectional area to the surrounding soil. Thus a single earth resistance of up to fifty ohms would be regarded as safe by American standards provided that the section and disposition of the earth terminals were such as to enable the charge to be safely dispersed. In practice, however, the ten ohms resistance limit has proved to be a safe criterion since, in most soils, this limit is achieved only by the laying of such masses. The necessity of measuring the potential gradient of the earth does not arise, as it may if the American standard is used.

Water Mains and Earthing Rods

Water mains fulfil the above earthing requirements and are particularly economical. Where no water main is available a copper or iron earth plate sunk on edge about 8 ft. deep is commonly used. The earth resistance is reduced by burying the plate in a bed of carbon, thus increasing the area in contact with the soil and decreasing the potential gradient between the earth terminal and earth. For this purpose the use of coke is to be deprecated due to its corrosive action on copper, and the use of wood charcoal is of no benefit since it has a resistance which tests have proved to be in some cases higher than that of the surrounding soil itself.

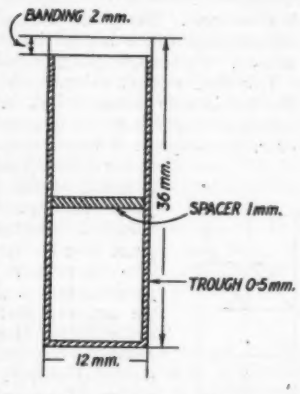
Earthing rods are becoming more commonly used due to their adaptability to difficult conditions. They do not require excavation and any number can be driven and connected in parallel to bring the earth resistance to a given limit. Care should be taken, however, to ensure that the distance apart of the rods is sufficient to prevent their individual resistance areas from overlapping. For exceptionally bad soil conditions iron pipes filled with carbon, or self-watering tubular earthing devices, give good results. Alternatively, the soil may be treated with magnesium sulphate or common salt. By such treatment the earth resistance may be decreased by as much as 50 per cent., but constant replenishment is necessary, and corrosion due to their use again presents difficulty. Soil treatment should not be used as a means of obtaining a low resistance from an earth terminal of small section, since it is obvious that though the earth resistance may be considerably improved a high potential gradient will still exist due to the small section of embedded metal.

Perhaps the greatest advance in lighting protection is the more general acknowledgment of the need for periodical tests of the earthing and in the use of a.c. for such testing. It has long been realised that d.c. tests are open to error both from the back e.m.f. induced between the two electrodes concerned in the test and from stray electrolytic currents in the earth, both sources of error being almost entirely eliminated by injecting a.c. into the earth for the purpose of the test. Instruments employing generated a.c. are now available in compact form.

Revising Motor Ratings. By "Designer".

AS motor manufacturers are constantly being asked to increase the output they can obtain from a given frame size, the designer is required to make more and more use of the active space and available materials in the machine. The active constituents are the iron or steel parts and the copper in the stator, rotor, field and armature. In recent years the massive cast-iron construction has been superseded by the lighter fabricated steel type, which reduces the physical dimensions to the minimum. The fluxes in the iron paths are usually the greatest which can be passed without "saturating" the materials.

The only method of attaining more output is to put more copper into the slots and fields. The copper in the field system is limited by the amount of space available between the field coils, and it is to the armature slots that we must look for more space. There is a limit to the width of the slot, namely, the density of the flux at the root of the teeth. The maximum allowable density for the type of machine under consideration must not be exceeded, and to obtain more copper in the slot the insulating liner must be cut down to the absolute minimum. The accompanying diagram represents a minimum slot liner which can be used for a standard machine and which will stand up to the wear and tear of winding.



The psychology of the winder must also be considered when determining the amount of copper to go into the slot and the thickness of the liner. If the winder knows that the winding is tight in the slot he starts the work under adverse conditions and is less able to make a good job of the work. To work theoretically to the limit and then advise the winding department that the winding is tight is useless.

The slot insulation shown in the diagram is 5 mm. thick and embodies 0.3 mm. thickness of mica or micanite on 0.2 mm. thickness of leatheroid. To protect the micanite in the slot tissue paper 0.1 mm. thick is sometimes pasted over it. The active depth of the slot is reduced by the amount of space allowed for banding and spacer between top and bottom coils. The wires in the slot are bunched together and the overhang is taped over. In the past the usual covering for the actual wires in the slots has been double cotton, fine double cotton, single cotton, and single silk used in the rotation stated. In smaller machines some manufacturers use enamelled wire, but in actual practice this covering is not good enough for anything but fractional horsepower motors. The latest development, and a saver of insulation space, is enamelled and paper insulated wire. The enamel forms a tough skin, the breakdown voltage of which is on the average 7,000 V, whereas d.c.c. wire can be broken down at 2,000 V. The paper covering varies from 2½ mils thickness in the smaller gauges (28-30 s.w.g.) to 5 mils thickness in the larger gauges, and it gives a mechanical covering to the enamel if the winder is careless.

To amplify the table of wire sizes the following example is given. The slot size is 12 mm. by 36 mm. deep. The useful slot is taken as 10 mm. by 30 mm., allowing in the width for the slot liner and in the depth for banding, slot liner, and spacer between the top and bottom coils. From the table it will be seen that the number of wires which can be placed in the slot in each case is

D.c.c. $\frac{10}{1.73} \times \frac{30}{1.73} = 5 \times 18 = 90$

Fine d.c.c. $\frac{10}{1.62} \times \frac{30}{1.62} = 6 \times 18 = 108$

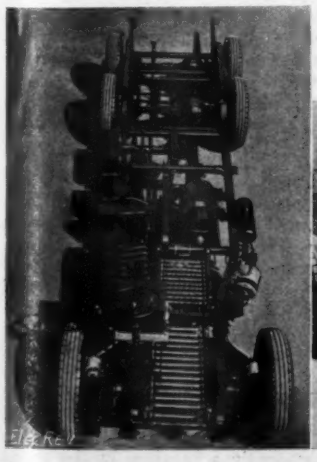
Paper and enam. $\frac{10}{1.55} \times \frac{30}{1.55} = 6 \times 19 = 114$

Thus there is a 20 per cent. gain in copper area when paper and enamelled wire is used in place of double cotton covered wire. This means that if more conductors are not required in the slot the area of each conductor can be increased, and usually the next full gauge larger than d.c.c. can be used. In this way the heating of the armature or stator is raised appreciably, and in many cases nowadays it is the sparking limit which determines the current which an armature will carry.

S.W.G.	Double Cotton Covered.		Fine Double Cotton Covered.		Single Cotton Covered.		Paper and Enamel.	
	Covering.	Thickness mm.	Covering.	Thickness mm.	Covering.	Thickness mm.	Covering.	Thickness mm.
16	10/12 mils	1.94	—	—	—	—	5.0 mils	1.76
17	10/12 mils	1.73	6/8 mils	1.62	—	—	5.0 mils	1.55
18	9/11 mils	1.5	6/8 mils	1.42	—	—	5.0 mils	1.35
22	—	—	6/7 mils	0.889	5 mils	0.864	4.0 mils	0.711
25	—	—	6/7 mils	0.686	5 mils	0.638	3.5 mils	0.508
27	—	—	6/7 mils	0.595	5 mils	0.547	3.0 mils	—

Trolley-buses for London

SIXTY-EIGHT of the trolley-buses to be built by Leyland Motors, Ltd., for the London Passenger Transport Board will be of the three-axle sixty-seater type. The driving motor will be arranged amidships in the chassis, but offset to the near side, and the drive to the foremost axle will be taken by a tubular propeller shaft supported on two mechanical couplings provided with needle roller bearings. A similar but shorter shaft will transmit the drive to the rear axle.



A general view and a "close up" of a trolley bus chassis for London Transport

The M.V. electrical equipment includes a compound-wound motor with a one-hour rating of 82 h.p. at 550 V and a continuous rating of 66 h.p. Electro-magnetic contactors, operated at line voltage, control the main and shunt fields. A scissors-type master controller is combined with a reverser under the driver's seat. The shunt-field resistance (carried on the chassis frame) consists of tubular units. The overload relay is automatically reset when the controller is returned to the off position; hand-closed circuit-breakers with a higher setting will operate on short circuits and serve as isolators.

Lighting at 24 V is supplied from a motor-generator which the combined product of C.A.V.-Bosch and Met-Vick., the former supplying the generator and control board and the latter the motor and insulation.

Speed is regulated by one pedal, the mechanical brake being applied on reduction to 4 m.p.h. Accleration is by cutting out series resistance, and serially weakening the shunt and series fields. On the return movement of the pedal the shunt field is strengthened causing regeneration, which is effective at 14 m.p.h. and is followed by rheostatic braking. Thirty of the vehicles have automatic brakes which limit the speed for running backwards on hilly routes to 2 m.p.h. A rheostatic brake limits the coasting speed to 10 m.p.h.

The bus can be manœuvred independently of the line supply by connecting in series the two sections of the 24-V lighting battery. Trolley collectors of the Brecknell Willis light-weight type are fitted.

The company has also received an order for 100 70-seater chassis and all-metal bodies.

Consumption Analysis. By G. W. Stubbings, B.Sc., A.M.I.E.E.

The use of statistical diagrams

A METHOD of forecasting the result of the revision of a sliding scale domestic tariff by the use of a cumulative frequency curve was explained by Mr. C. R. Cooper in a recent article in the ELECTRICAL REVIEW. Curves of this kind are of great value in analysing the use of the supply by groups of consumers occupying premises of the same size, as they convey much more vivid ideas than can be obtained by the study of tabulated records. Further, a succession of statistical curves, plotted at regular intervals, gives a very reliable indication of the value of educational publicity.

The meaning of a typical cumulative frequency curve applicable to a group of domestic consumers occupying premises of a stipulated size should be clearly understood by those who are unacquainted with the methods of statistical analysis. The ordinates and abscissæ of the curve are labelled, respectively, "Number of consumers" and "Annual consumption." Selecting any point on the curve, the meaning of the corresponding co-ordinates is that the number of consumers given by the ordinate is that of those whose annual consumption is not less than the number corresponding to the abscissa. Thus, if in such a curve the ordinate of a point is 200 and the corresponding abscissa 2,000, this would mean that, of the group of consumers considered, 200 had an annual consumption of 2,000 kWh or under. If we consider a narrow horizontal strip of the curve the number represented by the interval or height of the strip is that of the consumers whose annual consumption falls within the limits corresponding to the abscissæ of the strip. The area of the strip, therefore, represents the total annual consumption of that number of consumers comprised within the height of the strip, and the total area under the curve is proportional to the total annual consumption of all the consumers to which the curve applies.

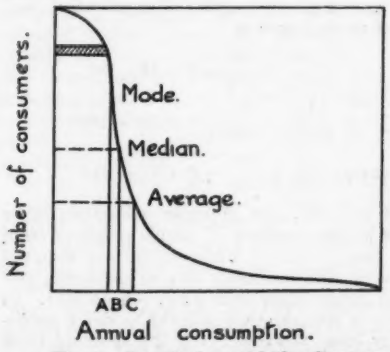


Fig. 1.—A typical cumulative frequency curve.

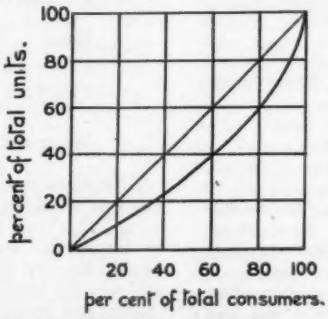


Fig. 2.—Lorenz curve

It is evident from this consideration that the average consumption is given by a horizontal line which divides the total area into two equal portions. This line is drawn in fig. 1, and the average consumption is indicated by the point C. This particular average value is usually known as the arithmetical average, and it is equal to the figure obtained by dividing the total consumption by the number of consumers considered.

In addition to this arithmetical average there are two other statistical averages which are of considerable importance, and which are readily derived from the geometrical properties of the cumulative frequency curve. One of these is what statisticians call the median, and this value is given by the intersection with the curve of a horizontal line whose distance from the axis is one half of the total height of the curve. The median consumption is that of the middle consumer of the whole group, when individual consumers are arranged or arrayed in order of annual consumption. The medial consumption is shown by the point B in the diagram, and the meaning of this particular average value is that there are as many consumers whose annual consumption is under this value as there are those whose consumption exceeds it.

An Important Value

A third average value of even greater importance and interest than those considered is what is called the mode. To understand the geometrical derivation of this average value, the characteristics of the curve need to be studied in a little greater detail. Consider the alteration in the number of consumers when passing from one annual consumption to another which is a very little lower. The reduction in the number of consumers evidently corresponds to those whose annual consumption ceases to be equal to or greater than the lower value. In other words, corresponding to a decrement of annual consumption, the corresponding decrement in the ordinate equals the number of consumers whose consumption corresponds to the value at the decrement. The slope of the curve, therefore, is proportional to the number of consumers whose consumption corresponds to the abscissa of the point considered. Thus, passing along the curve from the vertical axis, a small slope shows that the number of consumers with a very low consumption is small. The slope increases to a maximum and then decreases until, at the extreme right of the curve, the number of consumers corresponding to very high consumption is also small. The point of maximum slope gives the annual consumption which is used by the maximum number of consumers. This consumption is called the mode by statisticians.

This third average value, or the mode, is what may be called the fashionable consumption, in that it is the consumption which corresponds to the largest number of people. As, however, consumption of electrical energy does not follow fashion, in the ordinary sense of the word, a better non-technical phrase for the mode is the commonplace consumption. Now this modal or commonplace consumption, which is marked by the point A on the diagram, is that of the consumer who is neither very enterprising nor very parsimonious in the use of electricity. Indeed, we may say that the cost of the modal consumption represents the amount that the commonplace consumer is prepared to spend upon electrical energy. This modal consumption is really of greater significance than the arithmetical average consumption. The arithmetical average consumption of the consumers of a group can be increased by a relatively small number whose individual consumptions are abnormally high. Now excessive consumptions under a two-part domestic tariff are not necessarily remunerative to the undertaking, because they involve high peak demands, the cost of meeting which is not adequately covered by the rental charge. A high arithmetical average consumption of a group of consumers is not, therefore, so inherently desirable as a high modal consumption.

Regarded from the point of view of the possibility of increasing demand, the cumulative frequency curve is useful in enabling the arithmetical average and the modal consumption to be obtained by simple geometrical methods. The relation of these two averages is important, as it may be said that, when the modal consumption is markedly less than the arithmetical average, there appears to be a definite field for the stimulation of demand by educational publicity or by other means.

The comparison of cumulative frequency curves applicable to consumers, occupying premises of definite size and plotted for successive years, is very valuable in gauging the efficiency of a publicity staff. It is quite possible for there to be a steady increase in the arithmetical average consumption of the consumers of a class in spite of inefficient publicity, due to an extension in the use of electricity by consumers of the type who are interested in domestic electrical apparatus, and who will try out new appliances without persuasion. On the other hand, an increase in the modal consumption shows that the unenterprising consumer of moderate means has extended his use of the supply, and this, in turn, is a very good indication of effective publicity.

The Lorenz Curve

Another useful diagram which shows in a very striking manner the use of the supply by a group of consumers is what is known as the Lorenz curve. That corresponding to the cumulative frequency curve of fig. 1 is shown in fig. 2 and gives the percentage of the total consumption which is used by any given percentage of the total number of consumers. For instance, the curve shows that 60 per cent. of the total consumers only use 40 per cent. of the total consumption of the group.

The diagonal straight line to be seen in the diagram is the form the curve would assume if the consumptions of all consumers were the same. The deviation of the actual curve from the straight line is evidently a measure of the extent to which the average consumption of the group is increased by individual consumptions which, considered in reference to the constant rental charge paid by all consumers, are inordinate and probably unremunerative. The Lorenz curve is easily derived from the cumulative frequency curve by graphical integration. The frequency curve is divided into strips of equal height, and the area of each strip is determined. In this way a series of numbers representing con-

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

The I.E.E. Regulations

It has only just come to my notice that Mr. Thomas, in a letter in your issue of August 2nd, questions the authority for the statement in my article on "Organising a Changeover" which appeared in the ELECTRICAL REVIEW of July 19th, to the effect that "a supply authority now has power to enforce compliance with the I.E.E. Regulations if it considers such a course is necessary."

This statement was based on No. 27 of the Electricity Supply Regulations, 1934, made by the Electricity Commissioners. This regulation states that "undertakers shall not be compelled to give a supply of energy to any consumer unless they are reasonably satisfied in respect of the consumer's installation that . . ."—certain general requirements as to the adequacy, freedom from danger and protection of conductors and apparatus follow and the regulation concludes by saying that any consumer's installation which complies with the I.E.E. Regulations shall be deemed to fulfil its requirements.

I submit that this gives supply authorities the power to enforce compliance with the I.E.E. Regulations should they desire to do so. Whether or not it is the best policy to endeavour to do so is quite another matter. R. H. COBBOLD.

Winchester, *August 27th.*

Electrode Water-heating

I was interested to read details in your issue of August 23rd of the latest type of electrode water boiler introduced on the Continent, for which it is claimed that it "differs completely from all previous designs in principle and construction."

This statement does not agree with my information. From the following description of a boiler which appeared some years ago in a catalogue by a British manufacturing concern, it would appear that this design differs from the new boiler only in that it is horizontal and incorporates an additional method of load control and does not depend solely on regulation by jet adjustment:—

"The principle applied to this . . . boiler is that the energy transformation is located to a number of free water jets in the steam space of the boiler above the water level. The boiler water is circulated by a centrifugal pump of a special construction and the water is ejected through porcelain nozzles towards the electrodes. The water jets form compact high resistance conductors for the current and the heat is developed directly in the water . . . The direction of the water jet is altered in such a way that the length of the jet is either diminished or increased, thereby continuous input regulation is obtained within very wide limits. During regulation from maximum to zero, the jets are cut off one by one."

To me, the unit that you describe and the above, appear to employ the same principle and to involve difficulty in avoiding variations in the jets. Such a condition will produce an undesirable state of fluctuating unbalance that will be extremely awkward to control. With the electrodes completely immersed, unbalance under normal conditions of working is dependent on the initial mechanical adjustment and variation in the voltage between phases, and is controllable therefore within prescribed limits.

Again, the inference from the article seems to be that, with the established designs, the water round the electrodes is stationary; this is not the case, a centrifugal pump being provided (in addition to the ram feed pump) to circulate the water continuously. This feature is employed also in one all-British design to provide a cooled "lead in" and to ensure that the surface of the electrodes is kept free of gas bubbles, which would reduce the effectiveness and stability of the arrangement if they were allowed to collect on the electrodes.

I would also like to take this opportunity to suggest that more care and attention be given to the nomenclature applied to this class of equipment which is designed also for central warming systems using hot-water, as distinct from steam generation. The definitions, "electrode water-heater" and "electrode steam-raiser" respectively would be better than the hackneyed expression "electrode boiler" which does not differentiate. J. EDEN, A.I.H.V.E.

Hebburn-on-Tyne, *August 28th.*

The Organisation of Commercial Staffs

Once again the question of forming an association for the protection of salesmen and consumers' engineers, &c., has arisen. While it is quite obvious that such protection is necessary it is an unfortunate fact that the formation of another association is very definitely frowned upon in certain quarters.

A power station in a cornfield. This recent view of Barton, Manchester, shows the two new brick chimneys (replacing steel ones) one of which is complete. These are 180 ft. high and mounted on 120-ft. high towers; they have an internal diameter of 18 ft. 9 in.

There would appear to be only one way in which to solve the problem. If a sufficiently large number of those interested approached the Electrical Trades Union there is no doubt that they would be welcomed as members. This organisation would then be in a position to grade this class of worker in the same way as the manual workers are already graded.

I can visualise, in the near future, a powerful organisation catering for all grades of electrical workers. It is obvious that the only way in which proper protection can be afforded to all workers is by their uniting in one, and one only, practical association. It would be interesting to learn whether the E.T.U. would be prepared to co-operate in the realisation of this idea. J. RUSSELL HICKMOTT.

Ewell, Surrey, *September 1st.*

The Calculation of Meter Errors

With reference to the letter from "Testers" in your issue of August 30th, the function of a meter is to register amounts of electrical energy, and the error of the meter, as usually stated, is the difference between the actual amount of energy and the registration to which it gives rise, expressed as a percentage of the true value. Thus, if 60 kWh passes a meter and gives rise to a registration of 30, the meter is said to be 50 per cent. slow. As the rotating element of a meter is positively geared to the clock, the registration corresponding to a known amount of energy can be obtained by counting revolutions of the disc, and the meter can be tested by comparing the actual revolutions with those which would be executed, were the meter accurate.

If a meter is tested in this way the error is equal to the

Consumption Analysis.

(*Concluded from opposite page.*)

sumptions and numbers of consumers is obtained. These are then expressed as percentages of the total number of consumers and the total consumption, and these percentages are then plotted to obtain the curve of fig. 2.

From a cumulative frequency curve connecting the number of consumers with annual consumption it is easy to derive a similar curve connecting number of consumers with annual revenue when these consumers are supplied under a two-part tariff with a constant rental charge corresponding to the size of premises considered in forming the group. Since, under such a tariff, the functional relation between revenue and consumption is a linear one, it follows that the modal revenue will be that corresponding to the modal consumption.

The use of frequency curves in statistical analysis is similar to that of graphs in engineering and physical science. The curves contain no more information than the numerical data from which they are plotted, but they exhibit general tendencies, and show the relation of such characteristic quantities as the average the median and the mode much more strikingly than do tabulated figures.

difference between the correct and the actual number of revolutions, expressed as a percentage of the correct number. Thus, if 1 kWh should, according to the gearing of the register, require 200 revolutions of the disc, and if the passage by the meter of this amount of energy actually produces 100 revolutions only, the meter would be 50 per cent. slow.

There is, however, another method of testing meters which is in very common use. In this method the time required for the meter to execute a fixed number of revolutions is compared with the calculated time which would be required were the meter accurate. As the amount of energy passing the meter with a fixed kW loading is proportional to the time, this method of testing is evidently one in which the amount of energy giving rise to a stipulated registration is observed.

The true amount of energy corresponds to the observed time; the nominal or correct time is that corresponding to the registration, for this time would have been required had the meter been accurate. The error of the meter, being the difference between actual amount of energy and corresponding registration expressed as a percentage of actual energy, will therefore be calculated by expressing the difference between observed and nominal times as a percentage of the observed time. The formula for calculating meter errors from the results of "time tests" is therefore:

(Correct time − actual time) × 100/actual time.

This rule can always be remembered by considering a hypothetical case of a large error, such as is suggested by your correspondents. In this case, as the time required for a stipulated registration is 60 seconds, and the correct time is 30 seconds, the actual energy is evidently double the registration. The meter is, therefore, 50 per cent. slow.

London, S.E.25, *August 30th.* G. W. STUBBINGS.

I am interested to see that your columns are again ventilating this somewhat hoary chestnut, and it seems that the confusion which arises is due to the interpretation of what one actually means by a percentage error as applied to a meter. To commence with, surely a meter can never be more than 100 per cent. slow—when it obviously has stopped registering—and I would plead that it would be much better always to talk about the percentage registration of a meter and to fit the formula so that it obeys this fundamental idea. Thus a meter which is only revolving at three-quarters speed when full load is applied is 25 per cent. slow, but it is integrating 75 per cent. of the true registration, and similarly with other errors.

Demonstrating an electric stone-crusher at the Autumn Trade Fair, Leipzig

I think it should be borne in mind that it is quite possible for test sheets to be called for as evidence in a court of law, and much trouble may be saved if these can be made intelligible to the layman as well as to the technical engineer. If, due to recent happenings, supply authorities appoint "electric inspectors," these points may have added importance in the future.

Another point of interest is the interpretation applied to the errors of a check-meter when this has to be installed in cases of dispute. Assuming that the check-meter itself is within the statutory limits of error, it is, I believe, customary for the actual errors on the various tested loads to be arithmetically averaged, and this factor is applied when the account is adjusted, but it is interesting to note that although the accountant will apply the adjustment to four figures, the error given for the check meter may easily depart from the true conditions by, say, 1½ per cent., due to the fact that the greater proportion of the units have actually been taken on a particular loading of the meter. In the case of large consumers it is well worth while to go to the trouble to find out at what particular load the majority of the units are taken, and adjust accordingly. H. S. DRANSFIELD, A.M.I.E.E.

Wylde Green, Birmingham, *August 31st.*

The difficulty your correspondents who sign themselves "Testers" are up against would be easy of solution if they approached the problem from the registration point of view.

The meter that is 100 per cent. slow has not registered any advance because it has not rotated. The figures cited show that the supposed meter is rotating at half speed and will only register 50 per cent. of the true kWh. Furthermore British Standard Specification No. 37-1930 defines the percentage error on a revolution test as $\frac{T-t}{t} \times 100$, T being true time and t observed time. W. R. PEARCE.

London, N.19, *August 30th.*

[Replies have also been received from Messrs. J. F. H. Shaub (Battersea), W. H. A. Collins (Southall), R. D. Taunton (Edgbaston), J. Allan (Aberdeen), and F. J. Newell (Ilford).—EDS. ELEC. REV.]

"Let's All go All-electric!"

My house seems to be smaller than Mr. R. N. Jones's judging by the 5 per cent. assessment charge which amounts to only £2 10s. per annum, and at present my gas, coal and electricity (as in his column A) cost me £17 the same as his. Yet to do the same with electric heating and cooking would cost me about £27 per year.

The 2,000-W fire would be on as now during the six winter months for 15 hours per day making a total of 5,040 kWh. My 2-kW water heater running 14 hours per week would require 1,456 kWh; cooker and hot plates (6 hours a week—3 kW) 940 kWh; lighting 180 kWh per year; and electric iron 180 kWh per year.

I would very much like to see a similar hours-run analysis for your contributor's installation for comparison purposes.

West Wickham, Kent, *August 26th.* W. H. R. SAUNDERS.

In my article on the above subject I did not claim to be entirely all-electric, as from October to April. One coal fire is used at least part of the day, and this also heats the water supply. This was made clear in column C.

Column D in its original form was intended to show the consumption and cost of electricity *alone* before the deduction of discount, the fixed charge being 5 per cent. of the rateable value *per quarter*, and it refers to the same consumption as in Column C. Column C is the actual net cost of electricity and coal for twelve months (electricity £11 3s. 5d. and coal £2 15s.). Electricity in this column is charged for under the domestic rate, not, as stated, on the flat rate. I can assure Mr. Gostick that I had anything but a cold time and perhaps in view of this explanation he will change his opinion. It would appear that Mr. Gostick does not use coal at all; if this is the case his figures should be very interesting, as my ultimate object is to dispense with the one coal fire.

I set out in my article to show that if electricity employés will not set the example one can hardly expect the public to use more electricity. R. N. JONES.

Blackburn, *August 31st.*

[We are sorry to have misinterpreted the intentions of Mr. Jones in preparing for press the comparative table in his article. Column D, which has given rise to the criticism of our correspondents, was originally set out separately from the others and was headed "All-Electric Costs," which led to the impression that it referred to a different year in which electricity only was used.—EDS. ELEC. REV.]

Turbine Reliability

Although the leaderette in your issue of August 30th is "a striking illustration of the reliability of the modern steam turbine and its associated electrical plant," it is an even more striking illustration of the inefficiency of electrical generation as a whole.

A 41,000-kW unit supplies *one tenth* of the entire output of the statutory power stations. Here is a far more serious problem than the gain or saving of a few per cent. in the boiler house, turbine room, or distribution system. If this problem of load factor could be solved, electricity at one-fifth of a penny per unit—or less—would be available to all.

Lower down on the same page under "Free Electricity" you state: "The Hydro-Electric Commission of Ontario has arranged to let all rural consumers have free electricity for operating washing machines, radio sets or household pumps for a period of three years." Here is someone trying to solve the problem. Further on under "Electricity in the Garden" you indicate another method of obtaining the same result.

The problem boils down to the question of off peak loads and storage. The former is receiving a fair amount of attention, but electrical storage appears to have made no real advance since the time of Planté. Water can be stored; coal can be stored; oil can be stored; gas can be stored; but electricity—this is the problem. What are the Electricity Commissioners doing about it? A. S. HERBERT, M.I.E.E.

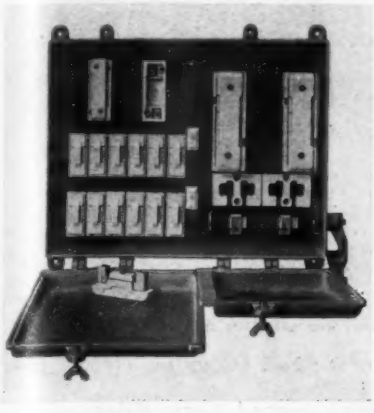
Northwood, *September 2nd.*

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Multi-way Splitter

The tenth edition of the I.E.E. regulations for the electrical equipment of buildings stipulates that every splitter unit having more than three double-pole ways shall have the main fuses combined with the main switch controlling the sub-circuits. A new ironclad switch-fuse controlled multi-way splitter complying with these conditions is now available from SIEMENS ELECTRIC LAMPS & SUPPLIES, 38, Upper Thames Street, London, E.C.4. The main switch and fuses are protected by a cover interlocked with the switch handle, while a separate non-interlocked lid is provided for the fuses of the sub-circuits.



The Siemens multi-way splitter

The fuse banks are wired direct to the main fuses, the fuses themselves being so disposed as to permit wiring without removing them from the box and to give direct entry to the conduit. The capacity of the standard size is: main switch and fuses, 60 A, 650 V, cooker circuit fuses, 30 A, 250 V, and sub-circuit fuses, 15 A, 250 V.

British National Fires

During a recent visit to the London offices of BRITISH NATIONAL ELECTRICS, LTD., Mossend, Lanarkshire, we were shown a large range of new electric fires of various types. The company has been very successful in its efforts to produce a fire with a realistic coal and flame effect.

In one model, the 2½-kW "Woodstock," there is a special arrangement in which the revolving "fan" over the lamp is shielded by a slotted "grid," the reflectors from this being thrown back on to a hammered reflector faced with sprayed gauze so that the impression gained when looking at the fire is one of sparks and smoke rising. The other three models in this series, the "Waverley," "Talisman," and "Portland," are given a similar finish, *i.e.*, imitation Portland stone, a new and attractive finish which is washable, and have a loading of 2 kW.

To relieve the stone colour of the fire, and to introduce a little contrast, chromium and ebony have been used in these models, and also in the "Raystone," a striking, if rather severe, design having two 1-kW closely wound helix type fire-bars placed in front of chromium plated one-piece pressed copper reflectors.

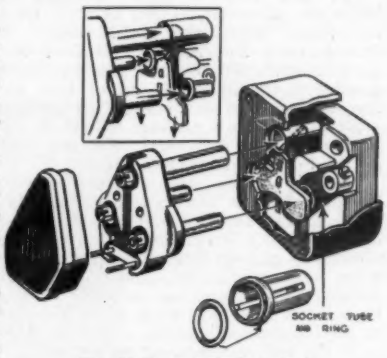
A striking design of panel fire in chromium and black (No. F.39) and a 1-kW fire with a stainless steel reflector, a chromium-plated tubular handle and substantial black vitreous enamelled feet complete this range.

There is also a luxury fire known as the "Lothian," which in view of the price is likely to have a very limited market. This design is a delightful example of high-quality work with its polished ribbed reflector and side dogs. The element in this case is behind the "coal" and facing the reflector.

A Safety Plug-socket

In order to ensure complete safety under all conditions and to comply with the I.E.E. Wiring Regulations a new type of "Anti-flash" plug-socket has been designed by M. K. ELECTRIC, LTD., Wakefield Street, Edmonton, N.18, conforming with B.S.S. No. 546, instead of No. 372, Part 2, which is now obsolete.

Following the usual M.K. practice, screens are used to provide the "anti-flash" feature and also to act as a protection in the case of misuse by children, but the new type of screen is one more fool-proof under those conditions, since it takes the form of a sliding shutter operated by the plug. A spring keeps it over the socket until released by the earthing pin as it is pushed home, while, since it is of the flat shield type, it is impossible for it to be forced open by pencils, &c. There is no overhang as the plugs cannot be inserted singly into the current-carrying sockets, and thus the size of the socket base has been reduced—in the 15-A size it is about 2¼ in. square.



The M.K. anti-flash socket

As with all M.K. equipment, the socket portion is made of vitreous porcelain, while the phosphor bronze sockets are fitted with a novel arrangement to ensure good contact with each pin of the plug. A double entrance ring is incorporated, consisting of an outer ring to prevent distortion of the socket and an inner spring ring which gives a permanent spring pressure. The plug is fitted with finger shields and a cord grip. The pins are of the "slotted" non-compressible type—that is, they cannot be compressed beyond the parallel position. Both 5 and 15-A sizes are available, but, at present, only the surface pattern is made.

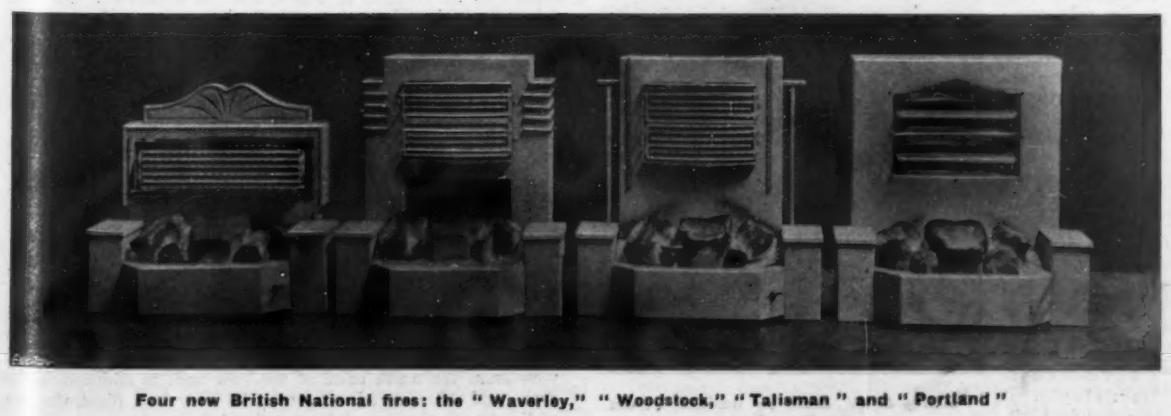
A Photo-electric Reflection Meter

A portable photo-electric reflection meter has recently been introduced by SALFORD ELECTRICAL INSTRUMENTS, LTD., Salford, for the purpose of measuring the approximate reflecting power and colour properties of paper, porcelain and other ceramic substances, textiles, powders, paints, &c. Variations in surface texture of different samples of the same material and the transmission and absorption of glasses, liquids, and other materials can also be measured.

This reflection meter comprises a lamp with dry battery, rheostat and switch, a photo-electric cell of the rectifier type, and a portable micro-ammeter connected by flexible leads, the whole being housed in a wooden box, measuring 7¼ in. by 5¼ in. by 3¼ in., and weighing less than 3 lb.; the lamp and photo-cell unit weighs only a few ounces. The photo-cell is annular in form, the central aperture being fitted with a small lamp bulb arranged so that no direct light falls on the cell. The whole unit is mounted in a small metal holder so that light is reflected on to the cell from the surface on which it is placed. In actual practice the holder is placed on a surface of known reflection factor, and the lamp current is adjusted by means of the rheostat until the pointer of the micro-ammeter indicates 100 per cent.

Radio Testing Instruments

Two new introductions by the WESTON ELECTRICAL INSTRUMENT CO., LTD., Kingston By-Pass, Surbiton, are a selective analyser (model 665) and an all-wave super oscillator (692). The first mentioned is a device for locating faults in a radio receiver without unsoldering any connections. It is designed



Four new British National fires: the "Waverley," "Woodstock," "Talisman" and "Portland"

as two units, the fundamental instrument and the circuit selector. The instrument itself is a volt-ohm-milliammeter with ranges to cover all the values met in servicing radio receivers, and can be used with the circuit selector as a selective analyser, or, with the test prods provided, as an ordinary voltmeter, milliammeter, ohmmeter, output meter, and capacity meter. By using the circuit selector a receiver may be tested under actual working conditions.

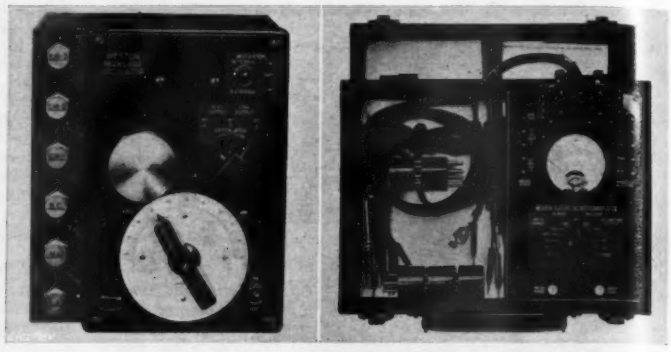
The new all-wave super oscillator attenuates below one microvolt, so that all a.v.c. receivers can be aligned below the a.v.c. point. Individual compartment shielding is provided at all frequencies from 100 kc. to 22 megacycles, making it possible to obtain a low output level and reduce the residual field surrounding the oscillator.

Model 692 gives a uniform output over each band because its six individual coils are carefully designed for each frequency band.

The coil plugs into a heavy cast-aluminium shielded chamber with a snap-on cap. The maximum voltage supplied to the attenuator circuit is controlled only by the individual coil, and is not affected by pick-up from other parts of the circuit. while electromagnetic and electrostatic fields within the oscillator are reduced to a minimum because all switching leads are eliminated. There is no interaction between coils, as only one coil is in the coil compartment at a time.

The attenuator system presents a constant output impedance of 200 ohms, and attenuation is not produced by shorting this, as is sometimes the case. The system is a double combination of rotating units. High and low output terminals are provided, giving a range of from below 1 microvolt to 0.2 V. Modulation is supplied by means of a separate low-frequency oscillator, remaining fixed at approximately 50 per cent. at all frequencies.

A two-section condenser is provided, a small section for short-wave coils and a large section for the lower frequencies, giving more efficient circuits. The oscillator is battery-operated.



The Weston oscillator and selective analyser

A Discharge Lamp Development

SIEMENS ELECTRIC LAMPS AND SUPPLIES, LTD., is marketing a new type of "Sieray" electric discharge lamp, developed in its Preston laboratory, and embodying two fundamental improvements; first-choke coils and condensers are eliminated, and secondly the light emitted is of a pleasing colour.

This lamp will be marketed under the name of "Sieray-Dual" and comprises a "Sieray" discharge lamp together with a tungsten filament, which is used to control the current in the discharge portion of the lamp, the normal tubular outer bulb of the "Sieray" discharge tube being expanded at its lower end to accommodate the filament so that the electric discharge lamp and its control are incorporated in a single unit. The tungsten filament operates at its normal efficiency and fills the dual functions of controlling the discharge and also emitting light in which is present a considerable measure of red rays which implement the greenish blue light from the discharge tube.

As no choke is used in the circuit the condenser used in the ordinary electric discharge lamp circuits for power factor correction becomes unnecessary, and due to this fact no alterations to existing wiring are necessary as the new lamps can be screwed into normal goliath holders and operated direct from the a.c. supply mains.

A Maximum-demand Alarm Relay

An impulse-type of alarm relay has been introduced by MESSRS. FERRANTI, LTD., Hollinwood, Lancs, operable on a maximum-demand basis. This instrument integrates impulses from a kWh or kVA meter. The alarm pointer can be adjusted to any demand figure, so that if during any five-minute interval the demand is such that its continuance for, say, thirty minutes would exceed the set value, contacts on the setting and driving pointers are closed and a visible or audible alarm device is operated.

The Ferranti m.-d. alarm relay

The five-minute time control is effected by means of a Ferranti self-starting synchronous motor. The overall dimensions of the instrument illustrated are 9¼ in. diameter by 5 1/16 in. deep.

Laying 33-kV Submarine Cable at Barnstaple

RECENTLY the Contracts Department of Callender's Cable & Construction Co., Ltd., undertook on behalf of the Bideford and District Electric Supply Co., Ltd., the provision of a 33-kV main from Bideford to Braunton, in North Devon. The whole of this work was carried out by means of an overhead line with the exception of the section across the River Taw. To cross the river on the route of the overhead line necessitated 800 yd. of 3-core l.s.d.w.a. 0.06 sq. in. submarine cable.

This is said to be the greatest single length of 33-kV cable ever supplied.

Before the cable could be drawn into position, not only had the site on both river banks to be made ready, but the cable drum had to be delivered from Belvedere to Barnstaple. It was nearly 12 ft. in diameter and with the cable in place weighed 21 tons. This huge load was hauled by road on a special carrier *via* Reading, Salisbury, Yeovil, Chard, Exeter, Tiverton and South Molton.

Putting 33-kV cable in position across the River Taw

The drum was transported to the north bank of the river three miles downstream from Barnstaple, but as no mechanical handling appliances were available at that spot the cable had to be paid off the drum direct from the carrier. Before reaching water level it was taken down through a 30-ft. shaft, then under the railway and road in ducts set in concrete, across the foreshore in a trench previously cut in the rock by pneumatic drills and then pulled across the river, being finally laid in the sandy bed of the river along a trench excavated at low tide; on the southern side of the river the cable lies in another trench across the foreshore. At both sides connections have been made direct on to the terminal poles of the 33-kV overhead line by means of special terminal connection boxes.

Elaborate precautions had to be taken in laying the cable owing to the extremely rocky nature of the estuary foreshore and also due to the strong and variable tides which held up the work at periodic intervals. The fact that this large weight of cable was successfully pulled across the river bed under these conditions without the slightest damage or delay reflects great credit upon the engineers and staff concerned. The completion of this contract was carried out well within the specified time.

Apart from the usual technical and practical considerations involved, the movement across the south and west of England of this very large drum caused considerable interest and a complete series of photographic records of the work has been obtained. The accompanying illustration gives a general view from the north bank of the Taw and, in addition to the drum and cable stretching across the river bed, illustrates one of the terminal poles of the overhead line.

Further Lamp Campaign Material

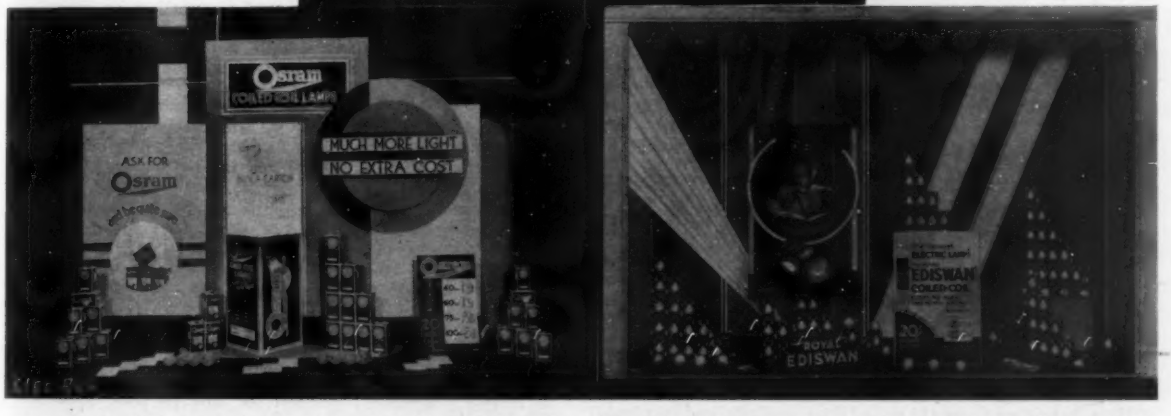
MESSRS. CROMPTON PARKINSON, LTD., have prepared a wide range of display material in connection with their lamp campaign, which will commence early in September, and will be backed up by extensive advertising in the national and provincial Press. Neon signs will also be erected in important centres throughout the country.

"Guard against Eyestrain with More Light from Crompton Coiled-coil Lamps" is the *motif* of the campaign, and an attractive child is incorporated in the chief display pieces. A large cut-out of a child's head, and the modern blue and yellow display cartons are built up into a window display which can be modified to suit three different sizes of window. A floodlighted display piece shows the child doing her homework by the light of a Crompton lamp, a 40-W lamp being used. A further cut-out featuring the same child's head is available for less elaborate displays.

There is also a "Crompton Stockist" indoor circular flashing sign with a neon effect for permanent window use, and a combined display card and carton container, in bright colours, for the counter. All the display material folds up for convenient handling.

The window display which the same company has prepared for dealers' windows has an attractive centrepiece similar in design to the cut-out to which we have previously referred, except that on the side panels there are requisite sockets for lamps on one side and a coiled-coil spring on the other. Well-arranged cartons and the automobile and coiled-coil lamp showcards complete an attractive display.

A novel publicity campaign for "Osram" lamps has been evolved by the General Electric Co., Ltd. Fresh from the "Os" and "Ram" campaigns which during the last two years have been prominent figures in the company's publicity, comes the scheme "Buy a Carton of Light." A series of advertisements which will appear in all the important national and provincial newspapers will illustrate graphically a number of simple homely situations where adequate light is of prime importance. The scheme, which will commence early in September, will also figure in trade journals.



A further selection of lamp publicity material available: Top: Crompton-Parkinson, Ltd. Left: General Electric Co., Ltd. Right: Edison Swan Electric Co., Ltd.

A number of new publications have been prepared by the Edison Swan Electric Co., Ltd. The new catalogue covers a large range of "Royal Ediswan" gasfilled, vacuum and carbon lamps, and includes the coiled-coil and all types of lamps for domestic and industrial purposes as well as traction and miners' types, sign lamps, electric discharge lamps, &c.

Three brightly coloured pamphlets deal specially with automobile lamps, coiled-coil lamps, and decoration electric lamp outfits respectively. The new window displays have as their centre-piece a mother and daughter reading with the aid of a "Royal Ediswan" coiled-coil lamp, and are completed with tastefully arranged cartons and lamps. The centrepiece is effectively illuminated by a 60-W lamp.

Cryselco, Ltd., whose publicity material was reviewed in our August 23rd issue, has since sent us its new season's catalogue. This elaborate publication contains full details of the company's range of lamps, with a section illustrating its colour-sprayed, natural coloured glass and daylight blue lamps. There are also illustrations of works in which "Cryselco" lamps are installed.

A broadside which covers the whole campaign has been prepared giving information relating to the window displays, and of "Osram" service. Specimens of the new season's literature will be forwarded with the broadside, while overprinted supplies are also available. A boldly designed showcard has been drawn up which shows a beam of light coming from the carton and illuminating the name "Osram," with the admonition "Buy a Carton of Light." This design is reproduced in colours in the sales literature and also in a neat folder container for counter display. The idea is further developed in a handsome counter cut-out which shows the carton of light in a shopping basket which is suggestive of action by the housewife in interpreting the slogan "Take Home a Carton of Light." There is also available an excellent setting for the dealer who decides to make a complete window display. The new catalogue is octavo size this year instead of the usual quarto, and is produced on cartridge paper.

The Electrical Situation in Denmark

THE recent improvement in the internal economic conditions of Denmark is reflected in her increased import trade. Industrial recovery during 1934 led to a heavy increase in imports, and the country's adverse visible trade balance increased to kr. 123.4 million, as compared with kr. 53.2 million. In his report to the Department of Overseas Trade on the economic conditions of Denmark (Stationery Office, 2s. 6d. net) Mr. E. G. Cable, Commercial Secretary to H.M. Legation at Copenhagen, states that efforts have been made by the National Bank during the current year to reduce this adverse trade balance, and through the Import Control Office imports of many commodities have been further restricted.

Dealing with Denmark's trade with the United Kingdom, Mr. Cable reports that although the value of the total exports to this country showed a decline there was some improvement in the value of machinery exported, including dynamos and motors, Diesel engines, and dairy machinery. Danish imports from the United Kingdom maintained in 1934 the upward tendency which characterised the preceding year. The available import figures show that the United Kingdom is obtaining an increasing share in the imports of dynamos and electric motors—about half of the trade, amounting to kr. 4 million, in 1933; the total imports of dynamos and motors, however, fell in 1934. Appendices to the report show that 64 metric tons of electric cables were imported into Denmark during 1934, as compared with 17 metric tons in 1933 and 420 metric tons in 1932. Electrical machines exported totalled 1,106 metric tons, against 1,531 tons and 966 tons respectively.

Regarding the State Railways, Mr. Cable says that in May last a special express service between Jutland and Copenhagen was inaugurated and four Diesel-electric coaches have been purchased. The electrification of the Copenhagen suburban lines and the inauguration of the new express service have compelled the State Railways to purchase much more rolling stock than usual. Forty-two electric motor coaches and thirty-one passenger carriages were acquired for the suburban traffic.

At the end of February, 1935, there were nearly 548,000 radio listeners in Denmark. This represents an increase of only 15,000 over the previous year and indicates that saturation point has almost been reached.

In proportion to the population Denmark has more telephones than any other country in Europe. The latest official figures, which are for the year 1933, show a total of 304,000 telephone subscribers on the lists of the six Danish telephone companies and the State-owned system in South Jutland. The two largest telephone companies in Denmark—the Copenhagen and Jutland companies—both report great increases in the number of telephone subscribers in 1934, and the figure at present is probably about 320,000, or nearly one telephone to every ten persons in the country. The Copenhagen Co. is converting its exchanges to the semi-automatic system but the work has been retarded owing to the difficulty of importing material. The Jutland Telephone Co. is planning the building of a new exchange at Aarhus and has opened two completely automatic exchanges in country districts. The material for the installation of the exchanges was supplied by the Swedish Ericsson Company.

New Books

Stage Lighting Principles and Practice. By H. C. RIDGE and F. S. ALDRED. Pp. 130; figs. 86. London: Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d.

At last we have a standard treatise on the methods employed in this country. The theatre technician, and both amateur and professional producers, have felt the need of such a book for some time past. We can congratulate the authors on not only their methed of presenting the various problems, but also on the thoroughness of the explanations and the enormous field that they have covered.

After an introduction by Herbert Prentice, of the Birmingham Repertory Theatre, there is an opening chapter on technical terms which is a glossary and explanation of the stage terms used in the "language" of the theatre, and should be of great value to the architect, consulting engineer, and contractor, who has not had experience of stage work before.

The second and third chapters, on "Electricity" and "Light," respectively, are, to the trained electrical engineer, rather elementary, but to the amateur, or even architect, who must study the subject, they will be of great value. The fourth and fifth chapters, on "Lighting Apparatus" and "Resistance Dimmers," give not only examples of the latest practice, but the former also fully describes the functions and positions of the modern units in to-day's schemes of stage lighting. To the electro-technician the chapter on "Reactance Dimmers" will be most interesting.

Chapter 8, on "Planning and Design," will not only interest the amateur and professional thespian, but also should certainly be read by all theatre architects. The reference to the cyclorama will enlighten many who no doubt have wondered what this particular piece of stage mechanism is, and particularly its connection with lighting. This chapter also deals with the subject of light control and fully describes the "Strand" light console, which was mentioned in a recent issue of this journal.

"Coloured Light" will, without doubt, cause a number of illuminating engineers to revise their methods and opinions, while the theatrical producer, dress designer, and scenic artist should make a point of learning the whole chapter off by heart. We have no hesitation in recommending the book to everyone who has to come into contact with the stage side of the tableaux curtains, whether he be engineer, architect, or actor.

Molybdenum Steels. By J. L. F. VOGEL and W. F. ROWDEN. Pp. 103; illus. Widnes: High Speed Steel Alloys, Ltd. Price 5s.

The appearance of a technical handbook on the manufacture and application of molybdenum steels is opportune in view of the rapid progress made during the past few years, the annual production in Great Britain since 1929 having risen from 35,000 to over 120,000 tons. This development is due to the effect of the element in improving the mechanical properties of steel at all temperatures and in eliminating temper brittleness. The most direct electrical bearing of the present work is the information relating to the addition of molybdenum to steel in the electric arc process and in the high-frequency electrical process. Furnaces for the latter process are now in operation, with capacities of upwards of five tons, and, as the authors state, are particularly suited for refining work in the production of high-grade alloy steels. Among the applications of molybdenum described is that relating to its use with cobalt and cobalt-tungsten steel magnets without altering their magnetic value. The functions of molybdenum are dealt with mainly from a practical aspect and should be useful to all interested in the production and use of alloy steels.

Elektrotechnik—(Vol II) Gleich-und Wechselstrom-Maschinen. By F. MOELLER and TH. WERR. Pp. 125; figs. 176. Leipzig: B. G. Teubner. Price 10 RM.

This book forms a second volume of a series and deals with d.c. and a.c. machines. It is divided into two parts (3 and 4 of the series). Part 3 has four sections: Production of voltage and torque; operation characteristics of motors; operation characteristics of generators; efficiency and heating. Part 4 has six sub-divisions: Transformers; general phenomena in a.c. machines; asynchronous motors; synchronous machines; commutator machines; and current rectifiers.

The treatment of such a wide range of machines in a comparatively small book is necessarily superficial. Further, apart from a small proportion of the contents, the subject matter seems to differ only slightly from what was taught in British electrical engineering degree courses twenty-five years ago. Even the diagrams are, for the most part, old and familiar. Some of these, *e.g.*, the illustrations of transformer construction, are crude as well as elementary. There is, in short, practically nothing of a novel nature in the volume.

On the credit side there are the merits of clearness of style and systematic arrangement. The printing and diagram reproduction are excellent. The book will be useful as an introductory course for students of electrical engineering, and might be of interest and service to non-electrical engineers wishing to acquire some insight into the construction and working of electrical machines.

An Introduction to Physical Science. (Second edition.) By CARL W. MILLER. Pp. 409; figs. and illus. London: Chapman & Hall, Ltd. Price 15s.

This book is one of several that have appeared in recent years in which a not unsuccessful attempt has been made to present an elementary account of the *whole* of physical science. In the majority of British universities the first course in physics neglects almost completely anything which has been discovered in this century, despite the fact that these discoveries are changing much of our lives. In the United States, Dr. Miller reminds us, some knowledge of physics is a "*sine qua non* of a well-rounded education," and "this primary function is not performed if the instruction must stop at the threshold of the newer developments." His course in Brown University, planned for this purpose, appears in this book.

Rather more than a half of the chapters are definitely classical. There is a proper insistence on mechanics, a branch of physics so frequently slurred over, to which the first seven chapters are devoted. These are followed by four chapters on heat, from which the historical experimental ballast, which encumbers so many texts, has been eliminated, leaving room for an account of the second law of thermodynamics. After this, electricity, magnetism, sound and light are dealt with in their various aspects, with a more or less continuously increasing emphasis on modern work right up to the last chapter, on cosmic physics. Roughly, what is included is the classical physics of an intermediate course, treated perhaps a little superficially by usual standards, but amplified with well-written accounts of the topics of atomic physics (extra-nuclear), nuclear physics, relativity, and wave-mechanics.

For use in teaching elementary university classes, the scope of the book appears rather too wide. Such students are usually profoundly interested in modern work so long as it is presented qualitatively and with reference to experiments; they are not actively interested in the difficult concepts associated with the theory of relativity and wave-mechanics, and it is questionable if such matters are ever appreciated by any but really good physicists. This criticism apart, little but praise can be written of Dr. Miller's book.

* * *

Shorter Notices

"Chemical Engineering Group Proceedings. Vol. XVI—1934." Pp. 125; figs. London: Chemical Engineering Group.

"Principles of Experimental and Theoretical Electrochemistry," by M. Dole. Pp. 549; figs. Price 30s. "Generating Stations" (Second edition), by A. H. Lovell. Pp. 438; figs. Price 27s. "Neon Signs," by S. C. Miller and D. G. Fink. Pp. 288; figs. 105. Price 18s. "Practical Radio Communications," by A. R. Nilson and J. L. Hornung. Pp. 754; figs. 434. Price 30s. London: McGraw Hill Publishing Co., Ltd.

"Alternating Current Practice," by C. H. Claude Cooke. Pp. 247; figs. 93. London: Crosby Lockwood & Son, Ltd. Price 9s. 6d. net.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

An American Company's Plans

We reported in our last issue that a new company, Searsint, Ltd., had been formed for the purpose of distributing American electrical appliances, such as refrigerators, sweepers and washing machines. These appliances, according to the *Financial Times*, are goods produced by the factories of the American mail-order concern, Sears Roebuck & Co., which are surplus to the company's requirements for the American market. The marketing of the products in this country will be done through the Great Universal Stores, a mail-order company which was formed in 1917; its chairman is Sir Philip A. M. Nash.

Electric Welding Progress

Though its expansion has been considerable during recent years, the electric welding industry must still be said to be in its infancy. At the well-equipped laboratories of the Quasi-Arc Co., Ltd., 15, Grosvenor Gardens, London, S.W.1, on Monday we had an opportunity of judging the efficiency of modern electric welding for a number of uses, both usual and unusual. These laboratories, which are at the disposal of anyone having a welding problem to solve, carry out extensive research work and exhaustive reliability tests of the welds. The Quasi-Arc Welding School on the premises provides training in the up-to-date theory and practice of electric arc welding, the course as a rule lasting about a month. An interesting film showed welding in progress in connection with the Lochaber hydro-electric scheme, Middlesbrough Bridge, oil tank construction, reinforcement of railway points and crossings, the *Peter G. Campbell* and the *Joseph Medill*, the last-mentioned being claimed to be the largest all-welded ship in existence. Incidentally, the company is confident that electric welding will be used exclusively in a few years' time, as it is said to be cheaper and more efficient than riveting.

A Radio Valve Manual

The Edison Swan Electric Co., Ltd., has published a comprehensive manual (pp. 125) for radio engineers and service men containing detailed information relating to "Mazda" radio valves. Full particulars are given concerning the operation of each type of valve, and there is also a series of typical circuits, including one utilising the latest "Ediswan" cathode-ray tube. A glossary of modern radio terms is included.

The New Showrooms of the Dublin E.S.B.

The accompanying illustrations are reproduced from night photographs of the new central showrooms of the Irish Free State Electricity Supply Board, Dublin. The window lighting was designed by the Colour Lighting Department of Holophane, Ltd., in conjunction with Mr. Davidson, of the Lighting Service Bureau, Dublin, and is an excellent example of modern stage-lighting practice as applied to shop windows. The lighting scheme has been planned as a stage scene, colours and drapings being used to create an "atmosphere." The main windows have three-colour lighting, and at the top of each window are two rows of three-colour battens with a footlight which can be moved to suit the display, and a portable groundrow batten on each side. There is also a row of window reflectors for white lighting when required. The curtains are on the Holophane festoon system, which permits various designs and openings in the back curtain. Each window is operated by an auto-controller for colour changing, and the windows can be operated out of sequence so that the effects in one window can be in contrast with the other when required. A special plug board has been designed for interchange of connections, so that the colour combinations can be varied. This adds increased flexibility to the system and permits the additional colour changes to be made without moving the equipment or display in the window. An entirely new attraction can be given to a display without any alteration, by simply changing the arrangement of the controls on the plug board in the showroom.

Holophane lighting at the showrooms of the I.F.S. Electricity Supply Board and (left) showing the three-colour battens and footlight for window illumination

Ward & Goldstone Developments

Messrs. Ward & Goldstone, Ltd., have received a large Government contract for "Goltone" inductors for suppressing electrical radio interference in heavy current circuits. Our picture shows a complete "Goltone" filter suppression unit (with cover removed) incorporating two inductors.

A "Goltone" filter suppression unit

The company has recently purchased land covering about two acres adjacent to its existing works. Extensions to the works are already well advanced and it is anticipated that the first large building will be ready for occupation in the autumn, so as to ensure prompter deliveries during the usual seasonal rush period.

Cable Production in Norway

A new cable factory is to be established at Drammen by the Kabelfabrikken Norge, A.S., with a share capital of kr. 200,000. The works will produce rubber-insulated conductors and other rubber goods, and practically all the share capital has already been subscribed.

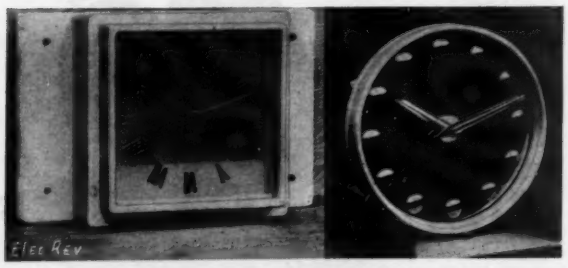
A National Code Proposed

At a recent meeting o fthe Council of the E.C.A., reports the *Electrical Contractor*, the Director (Mr. L. C. Penwill) referred to the communication sent by the E.C.A. and I.M.E.A. jointly to the I.E.E. asking it to call a conference of all interested parties to explore the possibility of a National Code of wiring rules. The matter had been referred to the Terms of Reference Committee of the Institution and a preliminary meeting between that committee and representatives of the I.M.E.A. and E.C.A. had taken place. The Director said he gained the impression that the majority of the Committee were very favourable to the matter being explored, but he understood that the possibility of further legislation was remote. A suggestion was made that some voluntary code should be adopted in the first instance. A statement was made by the I.M.E.A. representative that if the E.C.A. would bind its members to carry out work to an approved code, the I.M.E.A. would only connect up installations complying with such a code.

Mr. H. J. Cash said that the matter was extremely important. There was, however, a suggestion that it was necessary to get the Code first and then seek legislation. The only difficulty he saw in that was that the Code would constitute a minimum, and he feared that in time it would become a standard. A minimum needed compulsory enforcement, but without compulsion, the present comprehensiveness of the Tenth Edition of the I.E.E. Regulations was preferable.

Electric Clocks for the "Orion"

Messrs. Gent & Co., Ltd., were responsible not only for the complete system of bell indicators on the s.s. *Orion* (as mentioned in our issue of August 23rd), but also for the electric clocks. The master clock was the company's standard marine type "Pul-syn-etic" transmitter fitted with automatic advance as well as automatic retard mechanism, the current for the entire system being obtained from the ship's 220-V d.c. supply. There are in all seventy-six secondary impulse clocks, many of special and ornamental design, two of which are



Two examples of Gent electric clocks installed on the s.s. *Orion*

depicted in the accompanying illustration. One of the clocks installed is of a particularly novel design, consisting of a mirror glass dial with stars for the chapters. Another glass disc concentric with the dial carries the hour symbol in the form of the sun, while a further disc bears the minute symbol in the form of a crescent moon. These two glass discs are geared together in the usual way, and are operated by an impulse clock movement.

Trade Announcements

"Beeantee" Illuminations, Ltd., 88, Goswell Road, E.C.1, are opening a new department for all domestic appliances and electrical accessories, and ask for catalogues, samples and factors' prices.

Messrs. Marelli & Co., Ltd., are removing on September 16th to Artillery House, Artillery Row, Victoria Street, S.W.1 (telephone: Victoria 3476/7).

The British Electrical & Manufacturing Co. has removed its London depôt to 13, Charlotte Street, W.1. These premises include showrooms for the display of lighting fittings, domestic and industrial appliances and radio, and a trade counter. The telephone number remains unchanged.

Mr. J. A. Tasker, Loxwood, Sussex, is resuming business as an electrical engineer and contractor, after enforced absence following an accident, and asks for catalogues and lists of lighting, heating and power equipment, and radio specialities to be sent to him.

A Tool Encyclopædia

We have received from Messrs. Buck & Hickman, Ltd., 2, 4 and 6, Whitechapel Road, E.1, the 1935 edition of their general catalogue of tools and supplies for all mechanical trades. The first catalogue issued by the company sixty-eight years ago consisted of thirty octavo pages in a paper cover. The present edition has 1,158 pages in addition to comprehensive indexes to the various tools and to the figures with which the publication is profusely illustrated. The catalogue has been prepared with the object of rendering it serviceable to all users of tools and mechanical supplies and is standard work of reference. Its usefulness is considerbaly increased by the addition of formulas and tables and general engineering data. The volume is neatly bound in a strong dark red cover.

German Lamp Price Reduction

It is reported that the retail price of electric lamps in Germany has been reduced by 14 per cent. as the result of talks between the German Ministry of Economics and representatives of the electric lamp industry.

Prices of Materials

Messrs. Henry Gardner & Co., Ltd., report, September 4th: No change in the price of copper bars (best selected), sheet and rod and English pig lead.

Messrs. Edward Till & Co. report, September 4th: No change in the price of India rubber, Para fine.

Business Efficiency Exhibition

The Business Efficiency Exhibition, organised by the Office Appliance Trades Association, will be held at the White City from October 2nd to 12th.

Belgian Foreign Electrical Trade

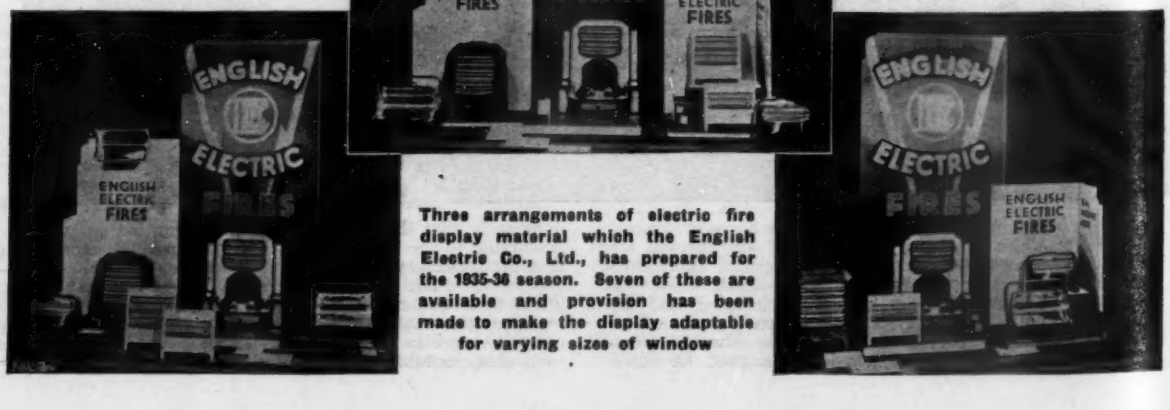
The following table shows the Belgian imports and exports of electrical machinery, apparatus and cognate goods during the first half of the current year as compared with the corresponding period of 1934, the values having been converted at the new parity rate of 147½ fr. to the £. It will be seen that both sections of the trade show a marked improvement.

	Imports. Jan.-June,		Exports. Jan.-June.	
	1934.	1935.	1934.	1935.
	£	£	£	£
Dynamo-electric machinery	126,620	156,145	94,362	60,810
Dry batteries	7,707	7,298	516	404
Accumulators and parts	7,645	8,300	8,108	6,890
Magnets, other than electro-magnets...	1,652	2,835	272	—
Land and submarine cable	2,766	4,070	73,310	73,308
Insulated wires and cables	24,880	31,652	73,269	72,425
Carbons and electrodes	15,032	13,833	77	84
Porcelain insulators	7,673	4,941	704	1,561
Electric globes, bulbs and glassware ...	19,634	20,697	11,526	11,018
Insulating tubes, junction boxes, etc.	11,066	14,927	7,290	4,711
Other insulating material	10,871	9,972	600	725
Arc lamps	630	378	28	—
Incandescent lamps	56,091	58,202	31,959	30,265
Radio valves	57,930	88,592	1,006	2,042
Electrical measuring instruments ...	65,603	56,209	4,028	2,014
Telegraphic and telephone apparatus	10,244	13,247	110,080	246,201
Radio sets and apparatus	162,160	132,550	11,729	31,802
Other electrical apparatus	348,147	396,836	55,580	52,523
Totals	£936,331	£1,018,732	£484,513	£596,778

Social Events

On August 31st the employés and friends of the Yorkshire Electric Transformer Co., Ltd., through the generosity of the managing director, Mr. W. M. Lydall, went for the day to Blackpool by coaches. Breakfast was served *en route* and lunch and tea were taken in the Baronial Hall, Winter Gardens; in the evening the staff were entertained to dinner at the Metropole Hotel. At luncheon Miss Barratt, the assistant secretary, wished the firm continued prosperity, and Mr. Hedley, the chief designer, and Mr. Walker, the works manager, referred to the success of the company, and proposed the health of Mr. Lydall. Mr. Lydall, in reply, expressed his gratitude for the excellent work of all the employés and staff. On behalf of the guests, Mr. Utley thanked Mr. Lydall for his generosity.

Unsettled weather conditions failed to damp the enthusiasm which prevailed at the "Clesco" (County of London Electric Supply Co.) nineteenth annual horticultural exhibition and garden party. The attendance of about 4,500 members of the company's Sports and Social Club and their friends was a considerable increase on the previous year's record figure, and, thanks to Mr. H. Brown (hon. secretary), everyone enjoyed a day packed with entertainment which included sports, a comic football match, guessing competitions, a treasure hunt, marionettes, a concert party, and other attrac-



Three arrangements of electric fire display material which the English Electric Co., Ltd., has prepared for the 1935-36 season. Seven of these are available and provision has been made to make the display adaptable for varying sizes of window

tions. The exhibition itself contained excellent examples of produce of the company's amateur gardeners, and the respective winners of the A. R. Bacon Cup, the Lady Renwick Memorial Challenge Cup, the Harry Renwick Memorial Cup and the Sir Bernard Greenwell Challenge Cup were Mr. G. Reed (Balham), Mr. A. E. Davie (Head Office) the Wandsworth team, and Mr. Stagg (Camberwell). These and many other prizes were presented by Lady Bethell, wife of Sir Thomas Bethell, J.P., a director of the company. Sir Robert Renwick, Bt., deputy president of the club, was also present.

The Penrith Agricultural Show

The accompanying illustration shows the joint exhibit of the Penrith and the Mid-Cumberland Electricity Companies, at the Penrith Agricultural Show on August 13th. The exhibits varied from small electric lighting fittings and lamps to sheep-

The joint display of the Penrith and Mid-Cumberland Electricity Companies at the Penrith Agricultural Show

shearing machines, churns, water pumps, refrigerators, cookers and wireless sets. Considerable interest was shown by the farming and general public in the exhibits and many inquiries were received for farming and domestic appliances.

For Sale

Northampton Transport Department has for sale one 500-V motor.

Sheffield Electricity Department invite offers for the purchase, breaking up and removal of four water-tube boilers.

(See our classified advertisements.)

New Catalogues and Lists

J. Stone & Co., Ltd., Deptford, S.E.14.—A catalogue dealing with P.I.V. variable speed chain gears and H-R reduction gears.

G. & J. Weir, Ltd., Cathcart, Glasgow, have issued an illustrated art catalogue of turbo-feed pumps, electrofeeders, and turbo-electric feed pumps.

Simmonds Aerocessories, Ltd., Shell-Mex House, Strand, W.C.2.—A booklet containing details of the Simmons (elastic stop) nut.

British Insulated Cables, Ltd., Prescot.—A booklet dealing with B.I. pillars.

Marconiphone Co., Ltd., 210/212, Tottenham Court Road, W.C.2.—A valve guide and leaflet on radio receivers and radio gramophones.

Watmel Wireless Co., Ltd., Imperial Works, High Street, Edgware, has published details of potentiometers, volume controls and variable resistances.

A.E.W., Ltd., Imperial Works, High Street, Edgware.—A leaflet describing the A.E.W. circuit-breaker.

General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—A booklet on sound reproduction equipment with notes on its application.

English Electric Co., Ltd., Stafford.—New catalogues of electric fires, and leaflets dealing with a "Handidrier," iron and breakfast cooker.

Whitworth Electric Lamp Co., Ltd., 6/10, Gorleston Street, West Kensington, W.14.—A price list of electrical wiring accessories, bells and bakelite accessories.

Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—A new electric fire catalogue.

Ward & Goldstone, Ltd., Frederick Road, Manchester.—Details of the "Statoformer" noise-reducing aerial system.

Simplex Electric Co., Ltd., 159, Great Charles Street, Birmingham, 3.—The new season's fire catalogue.

James Stott & Co. (Engineers), Ltd., Vernon Works, Oldham.—A catalogue of catering equipment for hotels, &c.

Private Arrangement

C. F. Gill and **S. T. Allsop** (trading as Cadenza Radio Co.), 48, Alfred Place, S.W.7, and 4, North End Road, W.14.—A meeting of creditors was held recently when a statement of affairs was submitted showing liabilities of £3,518, of which £1,191 was due to the trade; there were expense creditors for £36, and £2,291 was due to a loan creditor. The net assets were £202, leaving a deficiency of £3,316. It was reported that the business was commenced in March, 1933, with a capital of £100. In about two and a half years' trading the net loss was £1,000, whilst the partners' drawings and expenses totalled £815. In July last the landlord distrained on the premises at 48, Alfred Place. In the next month, the landlord distrained at 4, North End Road, and his claim was discharged by one of the creditors, who removed all the available stock. About a month ago most of the book debts and hire-purchase agreements were assigned to the second largest trade creditor. It was resolved to accept an offer of 2s. in the £ cash, provided all creditors assented within seven days. In the event of the offer being accepted the cash creditors undertook to stand aside.

Bankruptcy Proceedings

K. F. Butcher, lately trading as Radioelectric Co., 24, Well Hall, Road, Eltham.—The statutory first meeting of creditors under this failure was held on August 27th at the London Bankruptcy Buildings, when a statement of affairs was submitted showing total liabilities of £1,195 (ranking £185) and assets of £5. The debtor states that in October, 1930, he became a partner in a business carried on as Welling Radio Stores, but that partnership was dissolved in March, 1932. A year later he took over the Radioelectric Company's business and continued it until last December, when he was obliged to close down owing to falling away of trade and heavy overhead expenses. He filed his petition on August 13th and was adjudged bankrupt the same day. The case was left with the Official Receiver.

G. F. Kennedy (Kennedy & Co.), electrical engineer, Market Square, Shepton Mallet, Somerset.—The first meeting of the creditors of this debtor was held on August 28th at the Official Receiver's Office, 26, Baldwin Street, Bristol. The statement of affairs disclosed liabilities of £763 and a deficiency of £631. In 1927 debtor registered his business as Kennedy & Co., having previously been a director of a company which had gone into voluntary liquidation. He attributed his failure to business inexperience, local trade depression and keen competition. The case being a summary one was left in the hands of the Official Receiver as trustee.

F. V. Lambert, trading as "Lamberts," 31, Harmer Street, Gravesend, electrical contractor.—The public examination was held at Rochester recently. It was reported that the liabilities amounted to £971, and there were assets of £576, leaving a deficiency of £395. Debtor said that after assisting in his wife's business at Gravesend, in 1930 he purchased that business from her, and then transferred it to the Harmer Street premises. He was able to make a living until early in 1934, when trade declined and contracts became fewer. Debtor attributed his failure to ill-health, bad trade, bad debts, and heavy interest charges. The examination was closed.

J. F. Stillings, 27, Charnwood Road, Undercliffe, lately 1, Tennyson Place, Bradford, electrical contractor, &c.—The first meeting of creditors was held at the Official Receiver's Office, Hallfield Chambers, 71, Manningham Lane, Bradford, recently. The statement of affairs filed showed a deficiency of £346.

A. H. Latham and **R. C. Plant** (Latham & Plant), wireless and electrical dealers, 35, Lowlands Road, Harrow.—First and final dividend of 8¾d. in the £, payable any day (except Saturday) at Bankruptcy Buildings, Carey Street, W.C.

E. Howitt (Howard & Co.), wireless dealer, 368, South Road, Walkley, Sheffield.—Last day for receiving proofs for dividend September 16th. Trustee, Mr. L. J. Clegg, 14, Figtree Lane, Sheffield, Official Receiver.

W. C. Bryant, electrical and wireless engineer, 13, Rodbourne Road, Swindon.—First meeting September 6th and public examination October 15th, both at County Court Buildings, Clarence Street, Swindon.

E. H. Goldie (Dudley Radio and Electrical Service), radio engineer, Dunkerque, The Parade, Dudley.—First and final dividend of 4½d. in the £, payable September 3rd at the Official Receiver's offices, 1, Priory Street, Dudley.

E. J. Lovermore, electrician, The Cycle Shop, Queen's Road, Weybridge.—First meeting September 11th at 29, Russell Square, W.C. Public examination October 15th at the Guildhall, Kingston-on-Thames.

W. M. Horsfall, electrical engineer, 7, Redcross Street, Liverpool.—Trustee, Mr. J. Allcorn, Government Buildings, Victoria Street, Liverpool, Official Receiver, released August 22nd.

Company Liquidations

Ridout & Ratcliff, Ltd., electrical contractors, Capel House, 54, New Broad Street, E.C.—The accounts filed under the compulsory liquidation of this company show total liabilities of £3,292, assets of £1,234, issued capital £3,802, and a total deficiency of £5,860. The Official Receiver (who is acting as liquidator) reports that the company was formed in January, 1917, to carry on the separate businesses previously conducted by G. F. Ratcliff and L. Ridout. The company acquired the combined assets for £602 in cash, which were exchanged for shares to the same amount. The businesses throughout consisted of electrical wiring and repair work and the sale of electrical apparatus, and since 1925 had been carried on at 129, Crawford Street, W. Debentures for £1,300 were issued, and on May 13th, 1935, Mr. L. A. C. Ridout was appointed receiver on behalf of the bondholder. The assets are not expected to realise sufficient to discharge the prior claim of the debenture holder, and consequently nothing will be available for the unsecured creditors. The failure of the company is attributed to the reduced turnover during the past four years, chiefly due to the general trade depression, to keen competition in the trade, heavy overhead expenses, and shortage of working capital. The Official Receiver says that the failure is directly attributable to mismanagement on the part of the directors in that the company has been handicapped throughout by a lack of adequate working capital and, further, in that they permitted the businesses to be carried on for some time after it should have been apparent that heavy losses were being incurred.

W. S. Wilton & Co., Ltd.—Winding up voluntarily. Liquidator, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

Dissolution of Partnership

F. C. King & Co., dealers in electrical, wireless and gramophone accessories, 166a, Richmond Road, and 10, Four Elms Road, Cardiff.—Messrs. C. F. and F. C. King have dissolved partnership. Mr. F. C. King will attend to debts and carry on the business.

Electricity Supply

Lighting, Domestic, Power

Aberdeen.—A LOW FLAT RATE.—The Electricity Committee has approved the reduction of the lighting flat rate from 2½d. to 2¼d. per kWh, with a minimum charge of ten shillings per meter per half-year. There are other adjustments in a downward direction. For consumers using 5,000 kWh or over per half-year (lighting purposes) the new rate is 4½d. per kWh (present price 5¼d.) for the first hour daily of the maximum demand or its equivalent, and ¾d. per kWh (present price 1d.) for all subsequent supply. For power purposes the charge for the first 125 kWh per quarter is 1¼d. per kWh (compared with 1¾d.), scaling down to ¼d. per kWh for all over 5,000 kWh (as compared with 0.65d.). In the case of the domestic tariff for private houses the fixed annual service charge is to be 5 per cent. of the rateable value (against 6¼ per cent.) with a minimum of 35s. per annum (present minimum £2), with a running charge of ¼d. per kWh (against ½d.).

Bethesda.—LOWER CHARGES.—On the recommendation of the electrical engineer, Mr. Hugh Owen, Bethesda Council has decided to reduce the charge per kWh from 5d. to 4d., as from July 1st last.

Blackpool.—ILLUMINATIONS.—In connection with this year's illuminations, from September 14th to October 21st, extensions and the incorporation of bigger displays have necessitated the use of an additional 2½ miles of strip lighting, 100 poles, 8 miles of cable and 20 road junction curtains, apart from various new tableaux.

Cheltenham.—LOAN FOR MAINS.—The Electricity Committee has obtained sanction to borrow £1,294 for mains.

Chichester.—ELECTRIC-DISCHARGE STREET LIGHTING.—In conjunction with the city electrical engineer (Mr. R. V. Weare) the Engineering & Lighting Equipment Co., Ltd., is installing 6½ miles of electric-discharge lighting along the main roads of the city. The accompanying photograph shows the first section to be put into operation. The units consist of "Highway" fittings with "Sieray" 400-W electric-discharge lamps, the poles being staggered and spaced at 150 ft. The fittings are mounted at a height of 25 ft. It is claimed that Chichester is the first town on the South Coast to equip all its main roads with electric-discharge lamps. The same company has installed its "Vapoura" fittings for lighting the war memorial at Walthamstow, where the high intensity serves to illuminate, in addition, a large part of the roadway in the vicinity of the memorial.

Electric-discharge lighting at Chichester

Douglas (I.O.M.).—POWER STATION EXTENSIONS.—The Pulrose power station is being extended by the installation of a 3,750-kW turbo-alternator and a 40,000-lb. water-tube boiler, to the specifications of Mr. Bertram Kelly, the borough electrical engineer and manager. By this extension, which is being carried out at a cost of £40,000, the present generating capacity will be approximately doubled. It is expected that this new machinery will be ready for service shortly.

Eccles.—SUPPLY EXTENSION.—The Corporation has discussed the general question of providing electricity supplies to 725 houses on the Westwood Park estate, and is to circularise tenants to ascertain the additional quantity required. To provide an unlimited supply it would be necessary to lay mains and provide meters at a cost of £9,055; alter street lamps (£267); and provide wiring and fittings (£1,243).

France.—HYDRO-ELECTRIC PROGRESS.—It is anticipated that the work in connection with four large new hydro-electric development schemes in France will be completed this year. They are the Marèges plant (33,100 kW) of the Orléans Railway Co. in the Haut Dordogne department; the Santol plant (18,000 kW) of the Société des Forces Motrices Bonne-et-Drac; the Bissorte station (12,500 kW) of the Société Hydro-electrique de Savoie, and a large new storage lake at Chambon for the Société des Forces Motrices de la Romanche. A 4,850-kW hydro-electric plant is also rapidly approaching completion at Eylie (Ariege) and one of 5,870-kW capacity at Vintrou (Tarn). Work is well in hand on the construction of eight other hydro-electric plants with a total capacity of 53,000 kW.

Glasgow.—ELECTRIC HEATING.—The Health Committee, having considered the relative costs of heating the new infectious diseases hospital at Cowglen, has recommended that electricity shall be used for low-pressure water heating, domestic hot-water supply, lighting, laundry and general purposes other than cooking, consideration of the method to be adopted for the latter purpose being continued meanwhile. It is also proposed to enter into an agreement with the Clyde Valley Electrical Power Co. for a supply on the basis of a consumption of 4,500,000 kWh yearly.

Huddersfield.—REVISED CHARGES.—The Town Council has adopted the following revised tariffs: Lighting flat rate, 4d. per kWh; domestic cooking and heating, 1d. per kWh, with a minimum charge of £1 per annum; alternative charge for domestic consumers, 10 per cent. per annum on the rateable value up to £10, plus 7½ per cent. of the remainder of the rateable value, the maximum standing charge to be £4 15s. per annum, plus ¼d. per kWh for the first 360 per quarter and one-third of a penny beyond. Combined house and shop lighting, 4d. per kWh; power, 1d. per kWh. House and shop alternative tariff, standing charge of 12½ per cent. per annum of the rateable value up to £50, plus 7½ per cent. of the remainder of the rateable value, with a "unit" charge of ¼d. for all purposes. Industrial power and heating, 1d. per kWh. Alternative charge for lighting for single-phase (other than domestic) consumers, first 50 kWh per kVA of maximum demand per half-year 4d. per kWh, and remainder at 1d. per kWh. On a minimum consumption of 6,000 kWh per half-year a discount is to be allowed at the rate of 1 per cent. for the first 6,000 kWh, plus an additional 1 per cent. for each additional 1,000 kWh (maximum 30 per cent.). Commercial cooking and heating, first 100 kWh per kVA of maximum demand per half-year 1d. per kWh; remainder at ½d. After-hours' shop-window lighting, 1d.

India.—TEMPLE LIGHTING AT BOMBAY.—The picture below shows two lighting brackets fitted on the Parsi fire temple at Cusrow Bagh, Bombay, which is attached to a Parsi Hostel built by Sir Ness Wadia. The General Electric Co., Ltd., supplied the brackets, which were made to the design of Messrs. Gregson, Batley & King, Bombay architects, and incorporate many original features. They are probably among the largest electric-lighting fittings of their kind ever made, being 21 ft. 6 in. overall. The metal work is chromium plated, and the glazing throughout is of white-flashed opal. The fittings are 9 in. wide in the stem, and at the top is incorporated a shell-pattern design unit 3 ft. in diameter and made of sand-blasted plate glass with a satin-finished surface. This shell design consists of seven panels. Immediately below are chromium-finished metal leaf motifs with centre-pieces of white opal glassware, which form of glazing extends downwards to the base. Fifteen-watt lamps, spaced 6 in. apart, are used.

The Parsi fire temple at Cusrow Bagh, Bombay

Keymer.—STREET LIGHTING.—The Parish Council has accepted a three-year tender of the Central Sussex Electricity Co. for forty-two street lamps at £2 10s. per lamp per annum.

Kinross.—ELECTRICAL SCHEME.—The L.N.E.R announces that it is to introduce a system of electric lighting and power equipment at Kinross Junction, on the shores of Loch Leven. An automatically controlled electric pump is also to be installed for the purpose of providing a supply of water to the railway locomotives.

Lichfield.—EXTENSION.—The Rural District Council has consented to the Trent Valley & High Peak Electricity Co. extending its overhead lines from Longdon to Hanch Hall.

New Zealand.—HYDRO-ELECTRIC EXTENSIONS.—Additions which are now being made on the Arapuni hydro-electric site are sufficiently large for the housing of four new units, states the *New Zealand Engineer and Mining Journal*. One section of the work is already finished, and concrete foundations for walls are now being laid. The two new units which it is intended to install next year are each of 20,000 kW capacity, bringing the capacity of the station up to 85,000 kW. No. 1 unit, which failed in February owing to the destruction of the winding, is still inoperative. Three main transformer stations on the North Auckland sections are to be erected for the extension of the transmission system from either side of the line which is to be erected from Henderson to Whangarei.

North Westmorland.—RURAL ELECTRIFICATION.—The Rural District Council has consented to an application by the Westmorland Electricity Co., Ltd., for permission to erect overhead lines in various villages.

Norwich.—POWER STATION EXTENSIONS.—As we mention in a leaderette in this issue, extensions to the Thorpe power station are to be put in hand under the direction of the C.E.B. The capacity will be increased by 38,000 kW, and the estimated cost of the work is £465,500.

Petersfield.—RURAL EXTENSIONS.—The Mid-Southern Utility Co. has decided to lay an underground h.v. cable at East Meon and overhead lines at Hawkley, Steepmarsh, Coldhayes and Wheatham.

Plymouth.—ELECTRICAL DEVELOPMENT.—The Finance Commitee has approved a capital expenditure of £46,124 for electricity mains and £53,496 for transformers, switchgear, &c.

South Africa.—FUTURE OF BETHLEHEM'S SUPPLY.—Bethlehem, in the Orange Free State, is in a quandary regarding its electricity supply. The plant is quite inadequate, but ratepayers refuse to give the Council authority for its extension and the substitution of a.c. for d.c., at an estimated cost of £50,000. The Electricity Supply Commission has now offered to take over the plant, to assume responsibility for the commitments, amounting to £24,000, and to carry out an improvement scheme, provided it is granted a perpetual monopoly and that it receives the reserve fund of £17,000. It is contended that this would save the municipality £400 a year and make possible a lower tariff. The matter is still under consideration.

WATER-POWER PROJECT.—A company recently applied to the Water Court in Southern Rhodesia for permission to abstract water from above one of the minor waterfalls in an eastern district for the purpose of generating electric power to be used in the manufacture of paper from wood pulp. The project involves an expenditure of about £1,000,000 on plant, light railways and afforestation. The Court granted the right to the company, subject to the condition that at the end of four years there shall be a plantation of not less than 8,000 acres of trees, or 24,000 acres at the end of twelve years.

Southport.—LOWER CHARGES.—The Electricity Committee has reduced the heating rate for the two winter quarters from 1d. to ½d. per kWh and the power rate from 2d. to 1½d. per kWh.

NEW SUB-STATION.—The Electricity Committee is seeking sanction to borrow £6,000 for the erection and equipment of a sub-station in Cemetery Road.

ILLUMINATIONS.—The Attractions Committee has arranged to provide electrical illuminations at the marine lake, floodlighting and decoration of water craft in connection with a "Venetian Nights" scheme from September 14th to October 5th.

Scotland.—TWO-PART TARIFF.—Scottish Midlands Electricity Supply, Ltd., is to introduce a two-part tariff involving a fixed charge per quarter, plus ½d. per kWh.

Sunderland.—SUPPLY TO NEW HOUSES.—The Electricity Committee is to lay mains in Ocean Road to supply new houses.

Taunton.—ELECTRICITY UNDERTAKING'S JUBILEE.—This year marks the Jubilee of the electricity undertaking, and last Friday Mr. A. J. Howard, the borough electrical engineer, gave an address before the Rotary Club on the progress of the undertaking. The electrical history of Taunton, he said, could be traced back to the early days of 1879, when Mr. F. T. J. Haynes, then divisional electrical superintendent of the Great Western Railway, and Mr. F. H. Varley exhibited a 1,800-c.p. Serrin arc lamp which was run from 50-quart Bunsen cells. The first permanent power plant was inaugurated in Old Angel Court on December 12th, 1885. The present power station in St. James' Street was built in 1889.

Tonbridge.—A MAINTENANCE CHARGE.—The Urban District Council has decided to charge tenants of Council houses 4s. per annum through the meters for the maintenance of wiring and switches.

French Supply Statistics

THE new issue of the statistics published by the French Ministry of Public Works,* concerning the generation and distribution of electrical energy in France, relates to the year 1933 and is in a considerably abbreviated form. The tables omitted relating specifically to water-power stations, reservoirs, and distribution stations are to be restored in next year's issue.

The general development in the consumption of electricity is shown by the accompanying summary, comparing the figures for 1933 with those for 1932, 1930 (the peak year as regards generation and consumption), and 1925. The consumption per capita for lighting purposes alone was 39 kWh in 1933.

Year.	1925.	1930.	1932.	1933.
Population, in millions	40.61	41.61	41.84	41.88
Million kWh generated :				
Thermal stations	6,222	8,463	7,708	8,241
Hydro-electric stations ...	4,000	6,876	5,884	6,665
Total	10,222	15,339	13,592	14,906
Million kWh consumed :				
Electro-chemical	1,850	2,934	1,854	2,162
Distribution systems	5,100	7,806	7,479	8,003
Directly from station (traction, etc.)	2,010	2,895	2,483	2,605
Million kWh exported	40	101	96	70
Million kWh lost (transformers and conductors)	1,529	2,139	2,310	2,645
kWh consumed per head of population	225	327	282	304

The statistics relating to the equipment and generation in individual *departements* show the total installed capacity in thermal stations to be 6,953,702 kW, of which 4,867,262 kW is normally available; and the total installed capacity in hydro-electric stations is 3,205,742 kW, of which 1,369,377 kW is normally available. The distribution of the total generation between undertakings devoted mainly to the stated purposes is as follows :—

Main object.	Thermal stations. Million-kWh.	Hydro-electric stations. Million-kWh.
Distribution of electricity	2,237	2,442
Generation of electricity	2,352	2,048
Electro-chemistry or metallurgy	2	1,387
Mining	2,113	152
Metallurgy	1,400	77
Other concerns	77	559
Total	8,241	6,665

* *Statistique de la Production et de la Distribution de l'Energie Electrique pour l'Année* 1933. 8¼ in. by 5½ in. Pp. 29. Paris : Imprimerie Nationale (1935).

The average coal consumption (excluding lignite) of thermal power stations generating a total of 4,399 million kWh in 1933 was 1.70 lb. per kWh, compared with about 1.86 lb. per kWh in stations generating 4,138 million kWh in 1932. About 16.8 per cent. of the 3,350,000 tons of coal burnt in 1933 was imported.

Of the total output of energy from thermal stations, about 85 per cent. was derived from coal (including 10.3 per cent. from pulverised coal) and 11.2 per cent. from blast-furnace gas.

The lengths of distribution lines for various forms of energy were as follows† :—

Voltages between conductor and earth.	Length of lines.		Percentage.	
	Km.	Miles (approx.).	Overhead.	Underground.
D.C., not exceeding 600 V. ...	9,070	5,640	96.1	3.9
A.C., not exceeding 150 V. ...	135,368	84,200		
A.C., 150–250 V.	76,965	47,800		
High voltage	210,555	131,000	92.3	7.7
Extra-high voltage (60 kV or over for D.C.; 33 kV or over for A.C.)	15,979	9,930	97.0	3.0

A total of 6,574 million kWh was distributed at high voltage for traction, electro-chemical, electro-metallurgical and other purposes; and 2,619 million kWh was distributed at low voltage—1,651 million kWh for lighting and domestic purposes, and 968 million kWh for power applications. Including energy taken straight from generating stations, without distribution, the total consumption at high voltage for traction, electro-chemistry, electro-metallurgy and other purposes was 10,151 million kWh, making, with the 2,619 million kWh of low-voltage energy, a total consumption of 12,770 million kWh for the year 1933. The total number of low-voltage consumers was 9,398,668.

On January 1st last year there were approximately 3,360 communes (population 1,230,996) in which no electrical distribution was available. Energy distributed to consumers, as distinct from transmitted energy and bulk supply to other distributors, amounted to 9,193 million kWh in 1933, this being distributed by 1,745 networks of which 29 distributed more than 100 million kWh, 21 from 50 to 100 million kWh, 44 from 20 to 50 million kWh, and 1,651 less than 20 million kWh.

† Maps showing the distribution lines and generating stations of France, as at Jan. 1st, 1933, may be consulted at the offices of the Commercial Attaché to the French Embassy, 11, Waterloo Place, S.W.1.

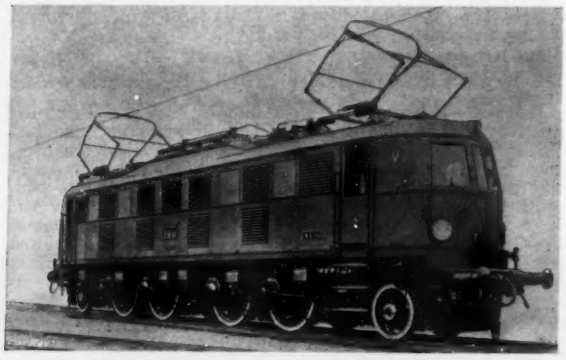
Traction

Australia.—TROLLEY-BUSES FOR ADELAIDE.—The Adelaide Municipal Tramways Trust has decided to introduce trolley-buses on the city routes. Tramways involved in the change are the services between Port Adelaide and Largs Bay, between Port Adelaide and Semaphore, and between Port Adelaide and Rosewater. The trolley-buses, for which contracts have not yet been placed, are to be of the latest double-deck type, and plans for running them to other suburbs are under consideration.

Bournemouth.—NEW TROLLEY-BUS SERVICE.—A new trolley-bus service was recently inaugurated between Cemetery Junction and Castle Lane, a distance of 1¾ miles.

Croydon.—TROLLEY-BUSES THIS MONTH?—It is expected that trolley-buses will be in operation in the town by about the end of this month.

Germany.—NEW ELECTRIC LOCOMOTIVES.—Seventeen high-speed electric locomotives have recently been supplied by the



One of the new German electric locomotives

A.E.G. for the German State Railways. They have a capacity of 3,200 kW at a maximum speed of 150 km per hour, the normal speed for which they are designed being 120 km.p.h. The bodies are specially designed to reduce wind resistance, while the frames are completely welded. On trial runs, with a train of 400 tons, a maximum speed of 165 km.p.h. was attained on the level, while 75 km.p.h. was reached upon a gradient of 22.5 per cent. The maximum accelerating pull is over 21,000 kg. at a speed of from 0 to 42 km. The gear ratio is 2.794 to 1, four motors being provided and one transformer. The conductor voltage is 15 kV and the frequency 16⅔ cycles.

A TRAVELLING TRANSFORMING STATION.—The Siemens-Schuckert Works Co., of Berlin has recently constructed a travelling open-air transforming station for the German State Railway authorities, for use on the electrified lines in South Germany. It is equipped with plant of a capacity of 6,500 kVA for stepping down 115,000 V power to 17,250 V. The transformers and control gear weigh nearly 72 tons and are mounted on a twelve-wheeled low-platform wagon weighing over 37½ tons, so that the total weight is nearly 110 tons.

South Africa.—CAPE TOWN TROLLEY-BUSES.—The accompanying photograph shows one of fifty new trolley-buses for Cape Town being embarked at the South-West India Dock, London. The vehicles, which were described in our issue of August 9th, are being supplied by Messrs. Ransomes, Sims & Jefferies, and will constitute the first step in the conversion of the Cape Town city transport from tramcars. The vehicles have all-metal bodies supplied by Messrs. Weymann's Motor Bodies, (1925) Ld.

Placing a trolley-bus on board the s.s. *Harmodius* for shipment to Cape Town

Warrington.—TRAM SERVICE DISCONTINUED.—On Wednesday last week the last tram service in the town was discontinued.

Communications

France.—NEW PARIS BROADCASTING STATION.—The new Paris P.T.T. broadcasting station, which is to succeed the present station at Rue de Grenelle, has now been completed and will come into regular operation shortly. It is situated at Villebon, 15 miles from the centre of Paris, and will broadcast on a wavelength of 431.7 metres. The station is said to be one of the best equipped in France. Experimental broadcasts began on August 15th with a power of 30 kW. This has since been increased to 80 kW, and will gradually be further increased to 120 kW. Special attention has been devoted to the problem of fading. The station includes four television circuits, states *The Times* correspondent.

LOWER TELEPHONE RATES.—An *Exchange Telegraph* message from Paris states that, as an experiment, M. Mandel, Minister of Posts and Telegraphs, has decided to make a uniform reduction of 2 fr. in daytime inter-urban telephone charges of 5 fr. and over. The night charges will be half of the day charges. The experiment was to commence yesterday (Thursday), and will continue for two months.

Germany.—SHORT-WAVE WIRELESS.—It is claimed in Berlin that by next year Germany will have the most powerful and well-equipped short-wave broadcasting centre in the world. At the moment the short-wave station at Zeesen has three transmitters, with beam aerials for North and South America, the Far East, and South Asia and Africa. A second station is now nearing completion at Zeesen. This will consist of two 20-kW short-wave transmitters, to which another two will be added at a later date.—*Reuter.*

Great Britain.—CROSS-CHANNEL CABLE CUT.—According to the *Financial Times*, a cross-Channel telephone cable, containing one of the only two lines from London to Geneva, was cut by a ship's anchor on Tuesday. The cable contained ten of the thirty lines from London to Paris, three to Zurich, two to Milan and one each to Marseilles, Basle, Madrid, Lille, Rome and Budapest. Later the same day all the services, with the exception of those to Paris and Lille, were working normally.

India.—RADIO DEVELOPMENTS.—According to our Bombay correspondent, a new broadcasting station is to be provided for Bombay in place of the present one. The latest type of transmitting equipment will be used, and there will be larger studios. The powerful new Delhi station is to begin transmitting early in January, and it is proposed to bring both the Calcutta and Bombay stations into line with it. Details regarding the full programme will be decided when Mr. Fielden, the new Controller of Broadcasting, arrives in India.

Italy.—RADIO-TELEPHONE LINK WITH ASMARA.—A radio-telephone service between Asmara, the capital of the Italian colony of Eritrea, and Rome, has been brought into operation, states a *British United Press* message.

London.—SOUTHERN RAILWAY TELEPHONE SYSTEM.—From October 1st the Southern Railway private exchange will be transferred from the Hop to the Waterloo Post Office Exchange, the number remaining 5100. This step is being taken as it is proposed to make the Waterloo Exchange automatic. The Southern Railway's private exchange, which was installed in 1925, is one of the largest of its kind in the country; it has 110 P.O. lines, with 875 extensions, and was the first automatic exchange to be introduced by any British railway company.

Luxemburg.—TELEPHONE WORK.—The underground cable network and the automatic telephone system are to be extended at a cost of 12 million fr.

Newfoundland.—A NEW RADIO STATION.—According to *Reuter*, the Government contemplates the erection of a broadcasting station at St. John's.

Norway.—NEW RADIO STATIONS.—According to *Telegraphen- und Fernsprech-Technik*, the new 1-kW radio station at Porsgrund, Frederikstad, has now been completed, while Aalesund-Vigra (10 kW) has begun test transmissions. Work has been commenced on the erection of Stavanger (10 kW), and a new station is to be built for Tromsö at Lyngen-Fjord.

Russia.—MOUNTAIN TELEPHONY.—*Reuter's Trade Service* learns from Moscow that the laying of telephone lines on Mount Elbrus, one of the highest mountains in Europe, has been completed. The two highest stations are on the western peak at 18,300 ft. above sea level and the eastern peak (17,940 ft.); other stations are at altitudes of 17,225, 13,650 and 10,400 ft. There are also stations at the Intourist Hotel (10,465 ft.) and the post of the Academy of Science (5,850 ft.).

South Africa.—SUBSIDISING WIRELESS FOR SCHOOLS.—All Government schools throughout the Transvaal have been circularised by the Provincial Education Department to the effect that it is prepared to subsidise the purchase of wireless sets by schools, on the pound per pound principle, up to £30. The decision is the result of the outstanding success of recent Rand experiments in school broadcasts for educational purposes.

AUTOMATIC TELEPHONES.—The automatic telephone system is now in process of extension to the outlying suburban districts. By the end of the year at least 6,000 automatic subscribers will be added and manual operation will be entirely eliminated from the Johannesburg city and suburban telephone system.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Alton.—September 9th. Joint Hospital Committee. Electric lighting at the Nurses' Home, Isolation Hospital. G. H. Webb. surveyor, Council Offices.

Australia.—MELBOURNE.—October 7th. State Electricity Commission of Victoria. Paper and varnished cambric insulated, l.c. wire armoured cables. (T.10047.)*

Birmingham.—September 26th. Electric Supply Department. Cable protective covers. (See this issue.)

Bristol.—September 11th. Baths Committee. Electric heating plant and hot water services for two new baths. (August 30th.)

Canada.—TORONTO.—October 1st. Department of Works. One 500 h.p. 2,300-V three-phase synchronous motor. (T.Y. 10077.)*

Cardiff.—September 16th. Electricity Department. Lamps. (See this issue.)

September 13th. Re-wiring and new fittings at the Gabalfa Baptist Church. Secretary, Chapel House, North Road.

Dagenham.—September 13th. U.D.C. Wiring for lighting and power at Riverside Sewage Works, Rainham. (August 30th.)

Eastbourne.—September 9th. Electricity Department. Tower wagon petrol-driven vehicle. (August 23rd.)

Eccles.—September 7th. Public Health Committee. Electric lighting, wiring and fittings in eighty houses on the Haddon Road and Regent Street estates. Borough electrical engineer, Electricity Offices, 1, King Street (deposit £1 1s.).

Egypt.—CAIRO.—October 7th. Department of Public Health. X-ray apparatus. (T.Y. 10063.)

GIZA.—October 8th. Ministry of Education. Radiophone transmitting set, television equipment and radio components. (T.Y. 10064.)*

Erith.—September 19th. Electricity Department. Transformer, switchgear, and laying, jointing and testing h.p. and l.p. cables. (See this issue.)

Farnworth.—September 12th. Electricity Department. Wiring cables, cookers, cooker control units, wash-boilers, and l.p. cables. (August 23rd.)

Hebburn-on-Tyne.—U.D.C. Electric wiring of sixty-six houses. T. A. Page, Son & Bradbury, 67, King Street, South Shields.

Hull.—September 13th. Maternity and Children Sub-Committee. Electric lighting and heating installations at the Maternity and Child Welfare Clinic, Ellerburn Avenue. D. Harvey, city architect, Guildhall (deposit £1 1s.).

India.—MALAKAND.—September 20th. India Store Department. Hydro-electric plant. (August 23rd.)

SIMLA.—September 19th. Stores Department. 320 wall mounting type house service distribution boards. (T.Y. 10076.)*

October 22nd. Stores Department. D.c. and a.c. electricity meters as required during the period January 1st, 1936, to December 31st, 1936. (T.Y. 10083.)*

Irish Free State.—DUBLIN.—September 20th. Electricity Supply Board. Meters. (See this issue.)

Leeds.—September 14th. City Council. L.p. switchgear. C. Nelson Hefford, general manager of the Electricity Department, 1, Whitehall Road.

Liverpool.—September 13th. Corporation. Equipment for fifty double-deck tramcars. (August 23rd.)

London.—BENGAL-NAGPUR RAILWAY CO., LTD.—September 11th. One 40-ton electric travelling crane. Company's Offices, 132, Gresham House, Old Broad Street, E.C.2 (deposit 10s., not returnable).

Newport (ISLE OF WIGHT).—September 23rd. Corporation. Electrically driven centrifugal sewage pumps. Sandford Fawcett & Partners, 53, Victoria Street, S.W.1 (deposit £3 3s.—cheques to be made payable to the Newport Corporation).

New Zealand.—WELLINGTON.—October 17th. Post and Telegraph Department. Battery plates. (T.Y. 10066.)*

October 29th. Secondary cells and accessories. (T.Y. 10068.)*

October 30th. Telephone relay and condenser strips. (T.Y. 10069.)*

November 12th. Secondary cells. (T.Y. 10070.)*

Plymouth.—September 18th. Corporation. Sub-station kiosk. (See this issue.)

Sleaford.—September 24th. Electricity Department. E.h.p. and l.p. mains, sub-station kiosk, e.h.p. and l.p. switchgear. (See this issue.)

South Africa.—CAPE TOWN.—October 2nd. Electricity Supply Commission. H.p. cable and underground cable joint boxes. (T.Y. 10061.)* Three oil-immersed 300-kVA three-phase transformers. (T.Y. 10060.)* Totally enclosed switchgear comprising three complete switchboards. (T.Y. 10057.)*

PRIESKA.—October 9th. Municipality. Electrical generating plant, switchgear, distribution and consumers' equipment. (T.Y. 10067.)*

South Shields.—Corporation. Electrical installations in 338 houses. Borough surveyor and architect.

Stoke-on-Trent.—September 11th. Electrical Engineer's Department. Cookers. (August 23rd.)

Swansea.—September 10th. Electricity Department. Machine tools for the Tir John power station. Borough electrical engineer, Guildhall (deposit £1 1s.).

Uruguay.—MONTEVIDEO.—October 18th. State Electricity Supply and Telephone Administration. Fifty-eight oil-immersed static transformers. (T.Y. 10059.)*

Walsall & West Bromwich.—September 16th. Barr Colony Joint Board. Supply of engineers' and electrical fittings for six months from October 1st. Clerk and steward of the Institution, Great Barr Park Colony.

Warrington.—September 16th. Electricity Department. Cables, earthenware conduits, cable protector slabs and tiles. (August 30th.)

West Lancashire.—October 7th. R.D.C. (A) Two sets of electrically operated automatic sewage pumping plants. (B) Two sets of electrically operated automatic screening plants. (C) Circular sprinkling filters, valves, penstocks, &c., required for the Sefton area drainage scheme. H. B. Ward, consulting engineer, 26, North John Street, Liverpool (deposit £5 5s. in each case).

West Riding.—September 14th. Mental Hospitals Board. Automatic telephones at the Menston Mental Hospital, near Leeds. W. E. H. Burton, architect and engineer to the Board, Mental Hospital, Wakefield (deposit £2 2s., to be sent to G. L. Banner, clerk of the Board, Board Offices, Victoria Chambers, Wood Street, Wakefield).

Wood Green.—September 7th. Town Council. Vehicle-actuated traffic signals at the junction of Myddleton and Palmerston Roads. R. H. Matthews, borough engineer, Town Hall (deposit £1 1s.).

Workington.—September 12th. Electrical installation work at fifty houses. J. Penman, borough surveyor, Town Hall (deposit £1 1s.).

Worsley.—September 7th. U.D.C. Electric lighting, heating, ventilating, hot and cold water installations, filtration plant and laundry equipment for swimming baths, &c. Bridgewater Road, Walkden. Ormrod, Pomeroy & Foy, architects, 21, Acresfield, Bolton (deposit £3 3s. to the Council's collector, Town Hall, Walkden, cheques to be made payable to the Worsley U.D.C.).

---

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Glasgow.—Cleansing Committee. Accepted. Seven electric traction batteries (£1,838).—Tudor Accumulator Co., Ltd.

Public Assistance Committee. Accepted. Two bed lifts at Crookston Home (£739).—Glasgow Engineers, Ltd.

Sub-Committee on Properties. Accepted. Pendant fittings for St. Andrew's Halls and City (Grand) Hall (£318).—General Electric Co., Ltd.

Libraries Committee. Accepted. Electrical installation at the Bridgeton Library (£206).—T. B. & J. A. Mathieson, Ltd.

Halifax.—Town Council. Accepted. Transformers for the period ending September 30th, 1936.—Bruce Peebles & Co., Ltd.

India.—Stores Department. Accepted. Nine sets of train-lighting batteries (Rs.23,679).—Chloride Electrical Storage Co., Ltd. Parts for telephone instruments (Rs.229), 200 lightning arresters (Rs.1,000), and sixty condensers (Rs.120).—Standard Telephones & Cables (India), Ltd.

Keswick.—U.D.C. Accepted. Electrical equipment at the sewage disposal works.—Blackstone Engineering Co., Ltd.

Leyton.—Town Council. Accepted. Two 500-kVA transformers (£344).—Hackbridge Electric Construction Co., Ltd. E.h.p. and l.p. a.c. switchgear and additional items (£425).—W. Lucy & Co., Ltd. Single and three-phase motors (£495).—Crompton Parkinson, Ltd.

Manchester.—Housing Committee. Recommended. Electrical installations at Council houses: 846 houses on the Wythenshawe estate.—H. C. Taylor & Co. 106 houses on the Newton Heath estate.—R. H. Clampett & Co., Ltd.

Transport Committtee. Accepted. Wiring of unit heating and extractor fan installation at Queen's Road depot.—S. H. Heywood & Co., Ltd.

South Africa.—JOHANNESBURG.—Corporation. Accepted. 107 miles of copper trolley wire (£69 per mile).—British General Electric Co. (South Africa), Ltd.

Wick.—Wiring 100 houses at three sites (£823).—John-O-Groats Motor & Electrical Engineering Co., Ltd.

Forthcoming Events

Junior Institution of Engineers.—Friday, September 6th. 6.30 p.m. Visit to the engineering plant at the Empire Swimming Pool, Wembley. Saturday, September 14th. 11 a.m. Visit to the Shipping, Engineering and Machinery Exhibition, Olympia, London.

Association of Public Lighting Engineers.—Monday, September 9th, to Thursday, September 12th. London. Annual meeting and conference.

Institute of Metals.—Monday, September 9th, to Thursday, September 12th. Newcastle-upon-Tyne. Annual autumn meeting.

Institute of Marine Engineers.—Tuesday, September 10th. Institute, London. 6 p.m. "Marine Electrical Installations in Service." Mr. H. G. Leivesley.

Shipping, Engineering and Machinery Exhibition.—Thursday, September 12th, to Saturday, September 28th. Olympia, London.

Iron and Steel Institute.—Monday, September 16th, to Thursday, September 19th. Manchester. Annual autumn meeting.

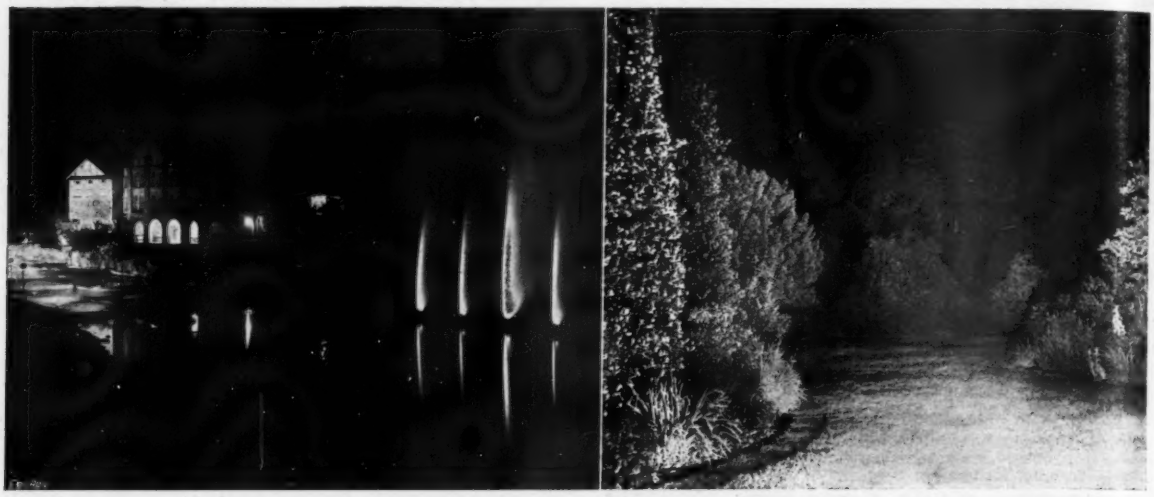
Notes

The Institution of Electronics

The Institution of Electronics was registered on August 28th as a company limited by guarantee, without share capital, with 1,000 members, each liable for £1 in the event of winding up. The word "Limited" is omitted from the title by licence of the Board of Trade. The objects are to promote information on the science of electronics and other scientific subjects; to hold and promote exhibitions of photographs, pictures and films produced by photographic, electrical or other processes, and instruments, apparatus, and other appliances connected with electronics or radio science. The management is vested in a council, the first members of which are:—J. J. Denton, research engineer; D. A. Bell, research engineer; C. W. H. Ashwin, radiographer; C. Williams, Royal Aircraft Establishment, Farnborough, research engineer; A. P. Twiss, consulting radio engineer; A. T. K. Moir, radiologist; T. W. E. Towers, sound film engineer; H. Moise-Bartlett; Matthew W. G. Russell; and H. V. Fowler-Wallis. The registered office is at 85, Gloucester Place, Portman Square, W.

Chester Illuminations

The use of illuminations to induce the public to visit our seaside resorts is now generally recognised, but the scheme inaugurated yesterday (Thursday) at Chester strikes a new note. This ancient city is unusually rich in historical buildings and natural beauties, both of which respond well to flood-lighting. Probably the outstanding features of the scheme are the lighting of the flowers and shrubs in Grosvenor Park and the extent to which water has been used to obtain spectacular results. A mixture of coloured light from "Osira" lamps and incandescent lighting with colour screens and inconspicuous reflectors spaced between the flowers has been made use of to advantage. Floating fountains are installed on the River Dee, these being illuminated by special waterproof "Marine" pattern floodlights equipped with various colour screens, while a sheet of spray on the far bank is colour-lighted. Another form of water installation has been carried out on the canal, where a sheet of water ejected through fish-tail jets passes in a wide curve over a battery of colour-flood-lighting projectors. Another feature of the river illuminations is the floodlighting in white light, with the niches picked out in colour, of the Grosvenor bridge. Festoons of coloured lamps are strung along the river banks, and neon lighting is provided on the old Dee bridge. The total floodlighting load is in the neighbourhood of 150 kW. The illuminations were prepared by the Electricity Department (engineer, Mr. S. E. Britton) and will continue for six weeks.



A river scene at Chester, showing the illuminated floating fountains, and (right) floodlighted shrubbery in Grosvenor Park

Protecting Cables

An excellent protection for cables which are exposed to excessive temperatures and the risk of mechanical damage will be obtained by winding a layer of asbestos tape over the insulation, and then giving it a brush coat of sodium silicate. As sodium silicate is corrosive to the flesh, gloves should be worn while applying it. It will on drying form a hard resilient coating both fireproof and resistant to mechanical damage. The tape and the coating will protect the underlying insulation from burning and external heat. Cables exposed to rough usage will have their life considerably prolonged by this treatment. If asbestos tape is not obtainable some measure of protection will be found in giving the cable a cheesecloth or muslin wrapping and applying to it a coating of sodium silicate. This will be effective but less so than the asbestos tape treatment previously mentioned.

Catching Them Young

The Electrical Association for Women believes in introducing the wonders and advantages of electricity to the rising generation at the earliest possible opportunity, and has just published a fascinating little fairy story entitled "The Rays" (price 6d.) by Mr. C. F. Smith, D.Sc., M.I.E.E., M.I.Mech.E., whose previous effort "Electricity Without Tears" has already done a good deal of useful service in clearing up the mysteries of electricity for the rather older children. The adventures of Hilda and the Light, Heat and Work Rays should inculcate in the young mind a familiarity with electrical ideas which will serve to dispel mental resistance which, in later years, is often unconsciously set up against electrical knowledge.

Probationary P.O. Engineering Inspectors

The *London Gazette* of August 30th contains particulars of regulations respecting open competitive examinations for the situation of probationary inspector in the Engineering Department of the Post Office. The age limits are 17-23, and the subjects of the examination are pure and applied mathematics, electricity and heat, engineering drawing and design, sound and optics, telegraphy and telephony, and chemistry. The next examination will be held on December 10th next, when twenty candidates will be appointed from among the entrants. The written examination will be held in London, and, if candidates present themselves in sufficient numbers, in Belfast, Edinburgh, Leeds, Manchester, Plymouth, and Portsmouth. Applications from intending candidates have to be in the hands of the Secretary of the Civil Service Commission by October 24th.

Educational

The syllabus for the 1935-36 session of the Sir John Cass Technical Institute is now available. It contains full information of the various courses in physics, chemistry and metallurgy. Particulars can be obtained from Mr. G. Patchin, Principal, Jewry Street, E.C.3.

The entrance examinations for day courses in electrical and all branches of engineering at Northampton Polytechnic, E.C., will be held on September 23rd and 24th, and enrolment for the evening classes will take place from September 16th to 20th.

Enrolments begin on September 16th for day and evening courses in electrical engineering and other subjects at the Borough Polytechnic, S.E.

Enrolments for the evening session, 1935-36, in the Electrical Engineering Department at the Regent Street Polytechnic will take place from September 16th to 20th, and two special courses of lectures on electrical technology will commence on September 23rd.

(See our classified advertisements.)

Appointments Vacant

Cable jointer for Rawtenstall Electricity Department.

Posts (evening classes) in electrical engineering, II and III, and electrotechnology at Wimbledon Technical College.

Junior scientific officer for the Department of Scientific Research and Experiment, Admiralty.

Lady as trainee for electrical housecraft and showroom assistant (male) for Cheltenham Electricity Department.

Lady cookery demonstrator for Plymouth Electricity Department.

Civilian technical officer at the R.A.F. Electrical and Wireless School, Cranwell.

Assistant lecturer and demonstrator at Faraday House Electrical Engineering College.

Two junior mains assistants for Ayrshire Electricity Board

(See our classified advertisements.)

Makers' Names Wanted

VESTA electric lamp.

H.H. glassware.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. W. H. Walton (of Pinching & Walton, Ltd.) has consented to serve a third term as chairman of the Executive Committee of the Electrical Contractors' Association. Mr. Walton was president of the Association in 1928-29. **Mr. H. J. Cash** has agreed to act as deputy chairman of the Committee *pro tem.*

[*Elec. Rev.* photo

Mr. W. H. Walton

Mons. Charles Fabry, director of the French Institut d'Optique, has recently been elected president of the International Lighting Commission.

Mr. S. H. Combe has been appointed a director of the Farnham Gas & Electricity Co., Ltd., in succession to the late Sir A. L. Dickinson.

Mr. C. W. Bridgen, general sales manager of Messrs. Ferranti, Ltd., was successful in winning the challenge bowl presented by the Radio Manufacturers' Association of Great Britain for competition at the annual joint meeting in Glasgow of the radio industry and the Scottish radio golf societies on September 2nd.

Mr. D. McIsaac, chief supervisor and draughtsman with the Scottish Central Electrical Power Co., who was married on August 27th to Miss Alice Tuson, of St. Michael's-on-Wyre, has been presented by his colleagues with a grandmother clock.

Bridlington Town Council has increased the salaries of the following officials: **Mr. F. R. Hobley,** mains superintendent, to £367 per annum; **Mr. H. P. Hainsworth,** sub-station engineer, to £388; **Mr. O. P. Johnson,** assistant mains superintendent, to £259; **Mr. G. Bannister,** shift charge engineer, to £225.

Mr. E. L. Gethin, engineer purchasing officer for Edmundson's Electricity Corporation, Ltd., was married at St. Margaret's Church, Manchester, on August 31st, to Miss E. Davies, daughter of Mr. W. Davies, of St. Werburgh's Road, Manchester.

Mr. A. B. Wishart has been appointed general manager of Messrs. Belling & Co., Ltd. Mr. Wishart was apprenticed to Messrs. A. G. Brown & Co., Ltd., engineers and colliery furnishers, of Glasgow, and was outside assistant to the managing director at the outbreak of the War. He went to France in 1914; he was twice wounded and was mentioned in despatches. In 1915 he was promoted captain on the field while with the Argyll and Sutherland Highlanders. After the War he was for four years agent and manager for the Hotpoint Electric Appliance Co., Ltd., for Scotland, and in 1927 he came to London as assistant manager of lamp sales to the British Thomson-Houston Co., Ltd., from which position he has resigned to take up his new appointment. He will commence his duties with Messrs. Belling in October next.

Mr. A. B. Wishart

Mr. A. D. Hegan has been appointed electrical engineer to the Crewe Corporation, and **Mr. C. Nunn** has been appointed deputy electrical engineer.

Mr. L. Clegg has resigned his position at the Southport Corporation generating station on securing an appointment at Doncaster.

Mr. W. T. Gann, A.M.I.E.E., of the Southport Corporation Electricity Department, has had his salary increased to £665 per annum, as from February 1st last.

Mr. J. Snow Huddleston has moved. His new address is "Wingletye," Broadway, Gidea Park, Essex. (Telephone: Romford 2496.)

Professor C. V. Christie, of the Department of Electrical Engineering, McGill University, has been elected vice-president of the American Institute of Electrical Engineers for the year from August 1st last.

Mr. George Barnard, M.I.E.E., Midland District engineer and manager for Callender's Cable & Construction Co., Ltd., has been appointed an advisory director of the company. Mr. Barnard celebrated his jubilee with the company in April, 1932, having joined it in 1882. Acting for Callender's, he put down the early underground street mains for private installations at Victoria (L.C. & D. Railway), at Gatti's, the Adelaide Gallery, Buckingham Palace, &c., in the early eighties of last century.

Mr. George Barnard

Mr. R. D. Reynolds, A.M.I.E.E., whose appointment as South-East England area officer of the British Electrical Development Association was announced in our July 5th issue, will commence his duties on September 16th. Mr. Reynolds has held the position of consumers' engineer to the West Gloucestershire Power Co., Ltd., since early in 1926, and during that period the development of the company has been such that the consumers have increased twenty-seven times, and the staff of his department has grown to ten times the original number. Three district showrooms for which he is responsible have been opened, and a travelling showroom has been put into operation. He is concerned with the commercial development of the l.p. system which includes the selling of apparatus, the running of cooker-hire and assisted-wiring scheme, exhibition and demonstration work. In this connection he has organised seven demonstration electric houses during his service with the company. Mr. Reynolds has acted as hon. secretary of the West Gloucestershire E.D.A. Circle, and has also been a member of the E.D.A. South-West Area Committee. His electrical training was received at Huddersfield, and before joining the Gloucestershire Co., he was assistant sales engineer to the Yorkshire Electric Power Co.

Mr. W. Robinson, the author of the article on "Lightning Protection" which appears on page 306 of this issue, was educated at Northallerton Grammar School, and served his apprenticeship with the Electric Supply Co., of Northallerton, and the Metropolitan-Vickers Electrical Co., Ltd., Manchester. After three years with the latter company he entered Manchester University, Faculty of Technology, and obtained second-class honours in electrical engineering, and while there carried out some research work on high-voltage phenomena. He was with Messrs. Dorman & Smith, switchgear manufacturers, Salford, for a time as sales engineer, leaving that company to take up his present position with Messrs. R. C. Cutting & Co., lightning-conductor specialists.

Mr. W. Robinson

Mr. G. M. Harriss, M.A., M.I.E.E., whose resignation from the position of general manager to the Dublin United Tramways Co. was recorded in our last issue, received his technical training at Finsbury Technical College, and was for a time with Messrs. J. E. Gordon & Co. Subsequently he went to Australia where he was engaged on railway and building contracts. He returned to England after nine years and took charge of the Bray & Carlow electrical schemes in Ireland. In 1907 he was resident engineer to the Irish International Exhibition, and later went to South Africa in connection with railway development schemes. Twenty years ago he was appointed electrical engineer to the Dublin United Tramways Co., eventually becoming general manager.

Mr. A. E. Hammersley, district mains engineer at Croydon for the County of London Electric Supply Co., Ltd., has, we learn from *County Pie,* been appointed engineer and manager to the West Kent Electric Co.

Mr. J. W. Holliday, area mains superintendent, Southern District, of the County of London Electric Supply Co., Ltd., has taken up an appointment with the South Metropolitan Electric Light & Power Co.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Bennett & Escott, Ltd.—Private company. Registered August 28th. Capital, £10,000 in £1 shares (5,000 6 per cent. preference and 5,000 ordinary). Objects: To acquire as from September 1st, 1935, the business of electrical engineers carried on by V. H. Bennett and T. H. Escott in partnership as V. H. Bennett & Co. (Electrical Department), at 8 and 9, Bond Street, Weymouth, and elsewhere, and to carry on the business of wireless, automobile, refrigerating and mechanical engineers, &c. The first directors are: V. H. Bennett, "Whitecross," Buxton Road, Weymouth, T. H. Escott and F. A. T. Escott, 6, Augusta Place, The Esplanade, Weymouth, and two others. Registered office: 8 & 9, Middle Bond Street, Weymouth.

Birmingham Insulators, Ltd.—Private company. Registered August 22nd. Capital, £1,500 in £1 shares. Objects: To acquire the business carried on by J. W. Benwell, as "Birmingham Insulators" at 56, Staniforth Street, Birmingham, and to carry on the business of manufacturers of and dealers in insulators, mica, bakelite, vulcanite, ebonite, porcelain and all materials or commodities used in the manufacture of insulators, &c. The directors are: A. W. Martin, 31, Westfield Road, Edgbaston, Birmingham, and J. W. Benwell, "Kenwyn," Walmsley Road, Sutton Coldfield. Secretary: H. Jones.

Bridlington Relay Service, Ltd.—Private company. Registered August 30th. Capital, £4,000 in £1 shares. Objects: To establish and develop a service for the relaying of radio programmes to subscribers and others in Bridlington and neighbourhood and to adopt an agreement with the borough of Bridlington. The subscribers are: A. G. Pickles, 11, Mayfield Road, Bridlington, and R. Ellis, 25, Meadowfield Road, Bridlington. The first directors are: R. Ellis (permanent), and others to be appointed by the subscribers. Solicitors: Lambert & Parkinson, 46, Market Place, Bridlington.

Wireless Hire, Ltd.—Private company. Registered August 29th. Capital, £500 in 250 10 per cent. cumulative preference shares of £1 each and 1,000 ordinary shares of 5s. each. Objects: To manufacture, let on hire, and install wireless transmitting and receiving apparatus, instruments and equipment, gramophones, &c. The subscribers are: G. H. Oakes, "Rose Villa," Lodge Road, Alsager, Ches. and A. Wood, "Overhouse," Burslem, Stoke-on-Trent. Secretary: Arthur H. Mountford, 131, Leek Road, Smallthorne, Stoke-on-Trent.

Allied Electrical Industries Finance Corporation, Ltd.—Private company. Registered August 31st. Nominal capital, £30,000 in £1 shares. Objects: To advance and lend money on real, personal and mixed securities, &c. The subscribers are: A. S. Wild, "Winterdyne," 178, Priory Road, Hall Green, Birmingham, and H. H. Sargood, 110, Holland Road, Kensington, W.14. H. H. Hughes is to be permanent governing director so long as he holds £1,000 shares. Secretary: Arthur S. Wild, Solicitors: Westwood, Morris & Co., Birmingham.

James Plucknett, Ltd.—Private company. Registered in Edinburgh August 30th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless, television, public address and gramophone apparatus, sets and components, broadcasting and relay apparatus, electric and gas plant, &c. The directors are: J. Plucknett, 12, St. Vincent Street, Edinburgh, J. A. Ramage Dawson, Balado, Kinross, and G. R. Fountain, Canterbury Grove, West Norwood, London, S.E.27.

Radio & Domestic Rentals (Luton), Ltd.—Private company. Registered August 28th. Capital, £1,000 in £1 shares. Objects: To carry on the business of inventors, designers and manufacturers of, agents for and dealers in, equipment, apparatus and supplies connected with wireless, television, telegraphy and telephony, &c. The directors are: A. Day, 15, London Road, Luton, and E. T. W. Day, 392, Leagrave Road, Luton. Registered office: 15 & 17, Upper George Street, Luton.

Aluminium Industries, Ltd.—Private company. Registered August 29th. Capital, £5,000 in £1 shares. Objects: To carry on the business of manufacturers and merchants of all kinds of aluminium and electrical goods, galvanisers, japanners, annealers, founders, &c., and to acquire the business carried on at Lye, Worcs., as Charles Eveson. The subscribers are: C. Eveson, 15, Ham Lane, Pedmore, and three others. Registered office: Engine Lane, Lye, near Stourbridge.

Electromatics, Ltd.—Private company. Registered August 26th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in vacuum cleaners and electric radiators, fires, cookers, irons, lamps, &c. The permanent directors are: H. Bates, 31, Clayton Road, Newcastle-on-Tyne, and C. G. S. Buist, St. Mary's Place, Newcastle-on-Tyne. Solicitors: Dickinson, Miller & Turnbull, Newcastle-on-Tyne.

Universal Electric Motor Co., Ltd.—Private company. Registered August 29th. Capital, £1,000 in £1 shares. Objects: To carry on at Slough, Bucks, or elsewhere the business of electrical engineers and contractors, manufacturers of and dealers in electric motors, &c. The first directors are: J. Winskell, 57, Selvage Lane, N.W., and two others. Secretary: H. V. Bunby. Registered office: Liverpool Road, Slough.

H. J. Coxon, Ltd.—Private company. Registered August 29th. Capital, £1,500 in £1 shares. Obects: To acquire the business of a radio engineer carried on by Harold J. Coxon at 240 and 243a, County Road, Walton, Liverpool. The directors are: H. J. Coxon and Florence A. Coxon, both of 9, Belvidere Road, Great Crosby, Liverpool. Registered office: 240, County Road, Liverpool, 4.

Returns of Electrical Companies

Perak River Hydro-Electric Power Co., Ltd.—The nominal capital has been increased by the addition of £2,498,116 beyond the registered and reduced capital of £501,884. The additional capital is divided into 998,116 new ordinary shares of £1, 1,250,000 non-redeemable preference shares of £1 and 250,000 "A" shares of £1 to be available either as preference or ordinary. (Note: This is in connection with a scheme of arrangement between the company, and (a) its 7 per cent. participating debenture stockholders, (b) its 7 per cent. participating debenture stock deferred interest warrant holders, and (c) its ordinary shareholders.)

Accumulator Service, Ltd.—Debenture dated August 14th, 1935, to secure all such sums as the mortgagees may be called upon to pay under a guarantee to the National Provincial Bank Ltd., and also all moneys due or to become due from the company to the mortgagees in any other manner whatsoever, not exceeding at any time £1,000. Property charged: The com-

Geo-electric Surveying in South Wales

THE preservation of plans of colliery workings was not compulsory before the passing of the Coal Mines Act of 1911, and the existence of flooded workings of unknown extent is a handicap to mining operations. Large barriers of coal have to be left unworked to avoid the chance of water breaking through, and accidents have been caused by the breaching of such barriers.

The detection of underground water was therefore one of the objects of the trials of geo-electric methods in South Wales by Prof. A. H. Cox, Dr. D. A. Bryn Davies, and Dr. T. G. Williams, of the University College of South Wales on behalf of the Department of Scientific and Industrial Research (Stationery Office, 2s. 6d.). Other and preliminary matters for investigation included the electrical behaviour of coal-measure strata, the possibility of mapping outcrops concealed beneath superficial deposits and determining their thickness.

Success would depend in the first place on the mine water having a resistivity differing sufficiently from that of the surrounding strata for its detection at the surface. The a.c. potential ratio method was first applied, but heterogeneities in the surface deposits called for the supplementary use of the "Megger" earth-resistivity method. Depth-resistivity tests were also made over the shallower water-logged workings with the "Megger," adapted for geo-physical work by the makers, Messrs. Evershed & Vignoles, and with the d.c. potentiometer, which, with the a.c. potential ratiometer, was supplied by Messrs. Tinsley to the design of Mr. Broughton Edge.

Concealed shale and sandstone outcrops were delineated with precision by the electrical traverse method, which is expected to prove of great value in the geological mapping of drift-covered areas. The current penetration with the a.c. potential-ratio method was theoretically great enough to reach down to the water-logged areas, but the effects so recorded usually corresponded with those recorded by the "Megger" indicating that the first was influenced primarily by resistivity variations near the surface.

The absence in most of the ratiometer experiments of any effect which could be attributed to the underground water-body indicates that the difference of resistivity between the water of the flooded workings and the surrounding rocks was not sufficient to outweigh the effects of resistivity variations in the strata at and near the surface. This is due to the low resistivities obtaining in the South Wales coal-measure strata; the mine-waters would need to have a high conductivity to be detected through the rocks.

The failure to detect the positions of the water boundaries, even in known and carefully selected areas, shows that it would be premature at the present stage to apply the methods to unknown areas. The experimental results emphasise the necessity of checking the deep-current penetration methods by shallow depth-resistivity measurements in order to analyse effects due to outcropping strata. They also emphasise the importance of plotting, with the help of the "Megger," curves of probe-contact-resistance as a means of ascertaining sudden differences in the behaviour of the thin surface layer.

The development of geo-electrical methods offers the best possibility of success in determining the position of water-logged areas. What is required is a method of integrating the results given by a deep-current penetration method with those given by an instrument designed for a shallow penetration only, so that a quantitative allowance could be made for purely surface effects.

pany's undertaking and property, including uncalled capital. Holders: Philco Southern Distributors, Ltd., 40, Station Road, Redhill, Surrey.

Laurence, Scott & Electromotors, Ltd.—Satisfaction (1) to the extent of £10,200 (amount issued) on July 1st, 1910, of debentures authorised November 9th, 1898, and registered November 8th, 1901, securing £18,000, and (2) in full on same date of debentures, dated July, 1898, and September 28th, 1906, securing £12,000. (Notices filed August 21st, 1935.)

Comet Battery Service (Hull), Ltd.—Debenture dated August 11th, 1935, to secure all such sums (not exceeding £2,000) which now are or shall from time to time be owing by the company to Philco Northern Distributors, 3, Queen Square, Leeds. Property charged: the company's undertaking and property, present and future, including uncalled capital.

J. & F. Stone Lighting & Radio, Ltd.—The nominal capital has been increased by the addition of £145,000 beyond the registered capital of £155,000. The additional capital is divided into 85,000 6 per cent. cumulative redeemable preference shares of £1 each and 240,000 ordinary shares of 5s. each.

N.E. Radio Relay Services, Ltd.—Particulars filed of debentures not exceeding £10,000, authorised August 15th, 1935, charged on the company's assets, present and future, including uncalled capital, the amount of the present issue being £4,000.

Scarborough Relay Services, Ltd.—Mortgage, dated August 2nd, 1935, to secure £800, charged on 28, Falsgrave Road, Scarborough. Holders: Mrs. L. Butler, Elm Villa, 32, Church Lane, Normanton, and R. C. Williamson, King Street, Wakefield.

Siemens Brothers & Co., Ltd.—Satisfaction to the extent of £490,300 on July 15th, 1935, of trust deed dated January 15th, 1918, and registered January 21st, 1918, securing debenture stock.

Granton Instrument Co., Ltd.—R. R. Smethurst, of 21, Spring Gardens, Manchester, was appointed receiver on August 9th, 1935, under powers contained in debenture dated July 26th, 1935.

International Refrigerator Co., Ltd.—The nominal capital has been increased by the addition of £50,000 in £1 ordinary shares beyond the registered capital of £50,000.

Kandem Electrical, Ltd.—The nominal capital has been increased by the addition of £4,000, in £1 ordinary shares, beyond the registered capital of £6,000.

Wireless-Electric (Wholesale), Ltd.—The nominal capital has been increased by the addition of £2,000 in £1 ordinary shares beyond the registered capital of £3,400.

Norman Clarke, Ltd.—Particulars filed of debentures not exceeding £1,500, authorised August 10th, 1935, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,500.

Lang Electrical Co., Ltd.—Capital, £100 in £1 shares. Return dated January 11th (filed March 29th), 1935. 51 shares taken up. £51 paid. Mortgages and charges, nil.

Electrical Name & Numeral Sign Co. (1931), Ltd.—Capital, £100 in 1s. shares. Return dated January 10th (filed May 13th), 1935. All shares taken up. £100 paid. Mortgages and charges, nil.

Hydro-Electrical Treatments, Ltd.—Capital, £2,000 in £1 shares. Return dated January 29th, 1935. 1,700 shares taken up. £1,700 paid. Mortgages and charges, nil.

T. C. Gilbert & Co., Ltd.—Capital, £5,000 in £1 shares. Return dated January 14th, 1935. 3,200 shares taken up. £2,300 paid. £900 considered as paid. Mortgages and charges, £269 9s.

A. & E. Hill, Ltd.—Particulars filed of £200 debentures authorised July 30th, 1935, charged on the company's undertaking and property, including uncalled capital, the whole amount being now issued.

Power Securities Corporation, Ltd.—Capital, £2,000,000 in 1,000,000 preference and 1,000,000 ordinary shares of £1. Return dated February 28th, 1935. 500,000 preference and 800,000 ordinary shares taken up. £1,300,000 paid. Mortgages and charges, nil.

Byfleet Electric, Ltd.—Debenture dated August 8th, 1935, to secure £495, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: H. W. Pengelly, "Arcades," Oakfield Road, Ashtead, Surrey.

Hydrelex Electrical Utilities, Ltd.—Particulars filed of £1,000 debentures authorised August 12th, 1935, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Arun Engineering Co., Ltd.—A. F. Sharp, of 14, Gray's Inn Square, London, W.C.1, ceased to act as receiver and/or manager on August 23rd, 1935.

Nefa Co., Ltd.—The nominal capital has been increased by the addition of £1,000 in £1 ordinary shares beyond the registered capital of £1,000.

Capel's Wholesale Wireless Co., Ltd.—Capital, £6,000 in £1 shares. Return dated February 28th, 1935. 4,500 shares taken up. £1,500 paid, £3,000 considered as paid. Mortgages and charges, nil.

Collectron, Ltd.—Capital, £1,000 in £1 shares. Return dated January 14th, 1935. All shares taken up. £1,000 paid. Mortgages and charges: £1,725.

Essex Magneto Co., Ltd.—Capital, £2,000 in £1 shares. Return dated January 22nd, 1935. 1,524 shares taken up. £1,524 paid. Mortgages and charges, nil.

E. P. Allam & Co., Ltd.—Capital, £6,000 in £1 shares. Return dated February 6th, 1935. 5,000 shares taken up. £2 paid, £4,998 considered as paid. Mortgages and charges, nil.

Continental Hydro-Electric Co., Ltd.—Capital, £20,000 in £1 shares. Return dated February 6th, 1935. 5,000 shares taken up. £5,000 paid. Mortgages and charges, nil.

J. H. Plant, Ltd.—Capital, £1,000 in £1 shares. Return dated February 28th (filed May 4th), 1935. All shares taken up. £2 paid, £998 considered as paid. Mortgages and charges, nil.

Wurlitzer Lyric Radio, Ltd.—Capital, £100 in £1 shares. Return dated February 5th, 1935. All shares taken up. £100 paid. Mortgages and charges: £1,000.

C. P. Roots, Ltd.—Capital, £600 in £1 shares. Return dated February 23rd, 1935. All shares taken up. £2 paid, £598 considered as paid. Mortgages and charges, nil.

Crampton & Co., Ltd.—Capital, £2,500 in £1 shares. Return dated March 25th, 1935. All shares taken up. £2,500 paid. Mortgages and charges, nil.

City Notes

The Southern Brazil Electric Co. reports that after providing for all expenses and adjustments, but before provision of exchange difference, there is a net loss for 1934 of £22,361, as compared with a net loss of £59,320 for the preceding year. The adjusted deficit brought in is £254,546, making with the loss for the year, exchange loss (£54,636), and portion of premium accumulated on 6½ per cent. debentures applicable to prior year (£19,536), a debit of £351,080. Remittance of funds from Brazil has continued to involve considerable difficulties and rates of exchange have remained generally low. There has been some improvement in general business conditions in the territory served by the company and its subsidiaries, to which the new and expanding cotton industry contributed. Although this additional business will have to be taken on at the low rates and tariffs fixed in the concessions under which the subsidiaries operate, it is hoped that some increase in revenues will be shown in the current year.

Telefunken Gesellschaft für Drahtlose Telegraphie.—According to the Berlin correspondent of the *Financial Times*, the statutes of this company have been altered by a decision dated August 17th last. The share capital, held in equal shares by Siemens und Halske A.G. and the A.E.G., is to be increased by Rm.8,000,000 (£666,000) to Rm.10,000,000 (£833,000). This increase is being taken over entirely by the two shareholders and is being carried out by cancelling two loans made to the companies by the Telefunken Company in previous years, the value of these loans being now assessed at Rm.8,000,000.

The Globe Telegraph & Trust Co., Ltd., has declared a quarterly dividend of 1s. 6d. per share, tax free, on the £10 ordinary shares. This compares with 1s. per share for the corresponding period last year.

Associated Fire Alarms, Ltd., has announced an ordinary dividend of 5 per cent., less tax, for the year to June 30th last (same).

The British Columbia Power Corporation has announced a quarterly dividend of 38 cents per share on the class "A" shares (same).

The Brazilian Traction, Light & Power Co. is paying a quarterly dividend of 1½ per cent. on the cumulative preference shares.

Brown Bros., Ltd., have declared an interim ordinary dividend of 2½ per cent. (unchanged).

Stocks and Shares

TUESDAY EVENING.

THIS week the only factor of real consequence in the Stock Exchange markets has been the likely issue of the League of Nations meetings. It may be that no great hope is built upon the possibility of the League being able to avert war between Italy and Abyssinia, but, on the other hand, a good many people place a certain amount of faith in the expectation that action by the League may have the effect of preventing other nations from being drawn into trouble. Prices of Stock Exchange securities have been fairly well maintained; it will be noticed, from the fluctuations in our tables, that the fall of last week has been stayed. Looking further ahead than the immediate future, the investor of to-day who has put his money into gilt-edged stock is inclined to ask whether the present political events may not materialise into a national loan for the expansion of the fighting forces of the Crown. It is true that abundance of money continues to be one of the outstanding features in the financial world, and that the owners of the capital are very willing to employ it in any security that offers, with safety, a better return than the banks give for deposit money. At the same time, the mere prospect, however vague, of fresh Government borrowing is sufficient to give pause to money that is awaiting investment. With the General Election in prospect, capital is inclined to adopt a "wait and see" attitude. If the "inevitable" does not happen, and a way is discovered whereby Italian-Abyssinian war can be averted, there will be, it is safe to say, a sharp rise.

Midland Electric Debenture

A new issue of stock which has just come to the market is £300,000 Midland Electric Corporation for Power Distribution 3½ per cent. first mortgage debenture. The stock is available in the market at 101¼ free of stamp fee. The yield comes to a little under 3½ per cent. Redemption can be effected by the company at 100 at any time after 1964 and the whole issue must be redeemed by 1973. The stock is a gilt-edged security, its interest service being covered many times over by the profits which the company made last year. Although the price looks expensive, it compares not too unfavourably with others in the same group.

Home Electricity Supply Shares

Mention was made here last week of the coming disappearance from our price-lists of the ordinary shares in half a dozen

of the London electricity supply companies that have now come into the control of the London Associated Electricity Undertakings. These six companies are the Brompton and Kensington, Charing Cross, Chelsea, Kensington and Knightsbridge, St. James' and Pall Mall, and Westminster. The companies retain their individuality but the shares have become merged into those of the clumsily-titled merger company. The shares of the latter stand at 34s. It is taken for granted that the dividend on these will be, for the next year or so, at the standard rate of 7 per cent. per annum, which at the price mentioned would give a yield on the money of £4 2s. 4d. per cent. By-and-by the dividend, it is thought, will be raised to 7½ per cent.—some think to 8 per cent. The shares of the newcomer, taking the place as they do of those in the other companies, are already regarded as being amongst the soundest in the industrial markets. Owing to the large number of shares available, there will always be a free market in them.

In lieu of the shares that have disappeared from our lists, a few extra securities have been introduced, namely, Edmundson's ordinary, London Associated Electricity ordinary, and, in the prior-charge stocks, London Power debenture and London Electric Transport guaranteed.

American Utilities

The fight continues to rage in the United States between President Roosevelt, on the one hand, and the holders of stocks, shares and bonds in the utility companies on the other. The conflict is somewhat reminiscent of those weather indicators of our youth, from one side of which a man would appear in wet weather, and, from the other side, a woman during a dry spell. The President and the companies appear and disappear with almost similar regularity. For the moment, the President seems to have won a decisive victory. By a measure just passed Washington has obtained control of the utility companies in the same kind of way as it holds in check the railroad companies. Such measures are, of course, purely socialist and have the support of theorists who think that employment and the interests of the community should be studied to the exclusion of everything else in matters relating to electricity supply, power and other such utility undertakings. It remains to be seen to what extent the latest measure will affect the profits of the utility companies and, also, whether the same sort of legislation will be applied across the border in Canada.

Victoria Falls

Deduction of the value of the rights from the price of Victoria Falls ordinary shares has left the quotation at 3¼. The rights consisted of three new shares given by the company in respect of every two old shares held. The latter were standing at 8½ per share, so that two of them, worth £16 5s. together, are now represented by five shares at 3¼, which comes to the same amount of money. The company has been paying 20 per cent. on the ordinary. Expectation looks for 10 per cent. on the increased capital. But in view of the manner in which South Africa is expanding under the genial influence of the gold premium, a 10 per cent. dividend on Victoria Falls ordinary is considered a conservative estimate.

Cable and Wireless

The market in Cable and Wireless stocks is quiet. No changes have occurred, but the "A" ordinary declined to 23¼ before recovering to 24. The Globe Telegraph and Trust has raised its quarterly dividend by 6d. per share, to 1s. 6d. This is in accordance with the chairman's promise at the meeting last June, the additional money being provided by the Trust's dividend from Cable and Wireless. It is not unreasonable to look for a higher dividend for the full year than the 7s. per share—3½ per cent.—paid for 1934. All these dividends are tax free. Cables Investment Trust 4½ per cent. preference remain at 5s. 6d. premium and the 3½ per cent. debentures at 10s. premium. The American stocks are steady. American Telephone and Telegraphs dipped to 135 and rallied to 137½d.

Manufacturing and Equipment

General Electric ordinary shares at 3 1/16 have added the fraction. Buying has been stimulated by the impression that the company may improve upon its last year's 10 per cent. dividend. As an innovation, it is thought that the G.E.C. may declare an interim dividend, instead of making only one payment in the year. Johnson & Phillips have regained, at 42s., most of last week's decline. Crompton Parkinsons are better at 66s. 3d. Reyrolles moved up to 64s. A relapse of 1/16 left Telegraph Constructions at 23s. 9d. Ericssons are 3s. 9d. up, at 7 7/16 on the share bonus that is about to be distributed. Telephone Manufacturing are better at 7s. 6d. On the other hand, Telegraph Condensers are easier at 46s. and Enfield Rolling Mills at 25s.

"Armaments"

The premature prophets have already started to prattle of a possible "Armaments Loan," for this country, and shares in the heavy industries are showing firmness in anticipation of increased activity due to Government orders. Babcock & Wilcox, however, continue dull at 2½. The rubber market is heavy. Prices went back by reason of a little selling by holders tired of dividends drawn only on the Bank of Hope.

Share List of Electrical Companies

	Nom.	Dividend 1933.	Dividend 1934.	Price Sept. 3.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	3¾xd	−⅛	3 17 5
City of London	1	7½	7½	38/0	−6d.	3 19 0
Clyde Valley	1	7	8	41/−	−1/−	3 18 0
County of London	1	10½	10½	55/6	−1/6	3 15 8
Edmundson's 7% Pref.	1	7	7	36/−	—	3 16 9
Do. Ord.	1	7	8	41/−	—	3 18 1
Elec. Dis. Yorkshire	1	9	9	48/−	—	3 15 0
Elec. Supply Corporation	1	11	11	3⅛	—	3 8 9
Lancs Light and Power	1	7½	7½	37/−	−1/−	4 1 1
Lon. Assoc. Electric	1	—	—	34/−	—	4 2 4
London Electric	1	7	8	38/6	—	4 3 0
London Power deb. Red.	Stock	5	5	109½	—	4 11 4
Metropolitan	1	10	10	52/−	−6d.	3 17 0
Midland Counties	1	7	7	37/−	—	3 15 8
Mid. Elec. Power	1	8	8	42/6	—	3 15 3
North Eastern Electric Ordinary	1	6	6	31/6	−6d.	3 16 2
Do. 7% Pref.	1	7	7	35/6	—	3 19 9
Northampton	1	10	10	52/6	—	3 16 2
Notting Hill 6% Pref.	10	6	6	14¾	—	4 1 4
North Met. Elec. Ordinary	1	10	10	58/9	—	3 8 1
Do. do. 6% Pref.	1	6	6	32/−	—	3 15 0
Scottish Power	1	8	8	41/3	—	3 17 6
South London	1	7	7	36/−	—	3 17 9
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/−	—	6 0 0
Yorkshire Elec.	1	8	8	44/−	—	3 12 9
PUBLIC BOARDS.						
Central Electricity, 1950–70	Stock	5	5	116	—	4 6 2
Do. 1955–75	„	5	5	118¼xd	—	4 4 4
Do. 1961–73	„	4½	4½	110	—	4 1 10
Do. 1963–93	„	—	3½	104	—	3 7 0
London Elec. Trans. Gtd.	„	—	2½	97	—	2 11 7
London & Home Counties, 1955–75	„	4½	4½	114	—	3 19 0
London Passenger Transport, A...	„	—	4½	123½	—	3 12 10
Do. do. B...	„	—	5	127½	—	3 18 9
Do. do. C...	„	3	—	100	—	3 0 0
West Midlands Joint Elec. 1948–68	„	—	5	115	—	4 7 0
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$100	9	9	137½	—	6 11 0
Anglo-Am. Tel. Pref.	Stock	6	6	116½	—	5 3 0
Do. Def.	„	1½	1½	27½	—	5 9 1
Cable & Wireless 5½% Pref.	„	2¾	4½	99½	—	4 3 0
Do. A. 7½% Ord.	„	Nil	Nil	24	—	—
Do. B. Ord.	„	Nil	Nil	7½	—	—
Globe Tel. & Tel. Ord.	10	2½	3½*	12¾	—	2 15 0
Do. do. Pref.	10	6	6	13¾	—	4 7 3
Great Northern Tel.	10	20	20	40	—	5 0 0
Marconi-Marine	1	10	7½	32/6	—	4 12 4
Oriental Telephone Ord.	1	12	12	3½	—	*3 13 10
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/6	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	„	5	5	1085	+10	—
Do. do. Pref. Ord.	„	8	8	177½	−4	4 10 2
Brazil Traction	100	—	—	7½	—	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	98½	—	5 1 6
Mexican Light Common	100	Nil	Nil	2½	—	—
Do. 7% Pref.	100	7	7	4½	—	—
Do. 1st Bonds	$500	5	5	35	—	—
Victoria Falls Ord.	1	20	20	3¼xr	—	—
West Riding	1	5	6½	36/3	—	3 11 8
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	10	15	3	—	5 0 0
Assoc. Elec. Ord.	1	4	6	34/−	—	3 10 7
Do. Prf.	1	8	8	37/6	—	4 5 4
Babcock & Wilcox	1	6	8	50/−	—	3 4 0
British Aluminium Ord.	1	5	7½	42/3	—	3 10 7
British Insulated Ord.	1	5	15	4½	—	3 6 8
Brush Ord.	Stock	Nil	Nil	49½	—	—
Callender's	1	15	15	3¾	—	4 1 4
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord.	5/−	—	12½	3⅛	+⅛	0 18 6
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Edison Swan 1st Pref.	1	7½	7½	27/6	—	5 9 0
Electric Construction	1	Nil	3½	24/3	—	2 17 9
Enfield Cable Ord.	1	25	25	5⅛	—	4 18 9
English Electric	1	Nil	Nil	17/6	—	—
Do. do. Pref.	1	Nil	Nil	22/6	—	—
Ever Ready	5/−	35	35	22/−	—	7 19 0
Ferranti Pref.	1	7	7	28/−	—	5 0 0
G.E.C. Pref.	1	6½	6½	33/9	—	3 17 4
Do. Ord.	1	8	10	3⅛	+⅛	3 5 8
Henley's	1	30	30	6¼	—	4 7 3
Do. 4½% Pref.	5	4½	4½	5½	—	3 16 8
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	5	7½	42/−	+9d.	3 11 5
Siemens Ord.	1	6½	4	22/6	—	3 11 0
Telegraph Construction	£1	Nil	Nil	23/9	−⅛	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1933

441. "Systems for transmitting electrical signals in dependence on variable conditions." J. L. Hodgson. February 6th, 1934. (432877.)

1934

856. "Liquid-level indicating arrangements." Electrical Improvements, Ltd., and C. L. Blackburn. January 9th, 1934. (433123.)

2358. "Apparatus for producing alternating electric currents." P. T. Hobson and W. Hill & Son and Norman & Beard, Ltd. January 23rd, 1934. (Cognate application 2286/35.) (432960.)

3232. "Miners' safety lamps." E. A. Hailwood. January 31st, 1934. (432962.)

3464. "Prepayment mechanism for the supply of gas, electricity, or the like." W. E. King and Gas Meter Co., Ltd. February 2nd, 1934. (432889.)

3544. "Manufacture of seam-welded metal tubes." J. A. Dorrat, E. G. Brownlow, and Associated Electrical Industries, Ltd. February 2nd, 1934. (433126.)

3611. "Methods of, and means for, cooling thermionic valves." Marconi's Wireless Telegraph Co., Ltd., and P. E. Privett. February 3rd, 1934. (432891.)

3748. "Traffic-control signals." Automatic Electric Co., Ltd., and A. P. B. Renshaw. February 5th, 1934. (432900.)

3763. "Mountings for instruments." British Thomson-Houston Co., Ltd., L. Griffiths and S. H. Franklin. February 5th, 1934. (432903.)

3835. "Cooking and like ovens." Revo Electric Co., Ltd., and F. H. Reeves. February 6th, 1934. (432906.)

3838. "Insulators for fastening electrical conductors to walls and the like." Heliogen Elektrotechnische Fabrik H. Pawlik Ges. February 6th, 1933. (433130.)

3861. "Temperature-regulating devices." Igranic Electric Co., Ltd., and S. R. Wright. February 6th, 1934. (Cognate applications 4765/34, 14775/34, 14916/34, and 23144/34.) (432909.)

4013. "Means of, and apparatus for, conducting telephony through cables over long distances." W. Estaugh. February 7th, 1934. (432967.)

4020. "Thermionic valve-holders or other electrical plug-and-socket contacting devices." Pye Radio, Ltd., and C. E. M. Butler. February 7th, 1934. (433046.)

4021. "Resistance units and method of making the same." International Resistance Co. February 9th, 1933. (Cognate application 4022/34.) (433047.)

4036. "Cathode-ray tubes." Fernseh Akt.-Ges. February 10th, 1933. (Addition to 23681/33.) (432970.)

4043. "Brushes and brush-holders for dynamo-electric machines." British Thomson-Houston Co., Ltd., A. A. Pollock and J. A. Jaffrey. February 7th, 1934. (432972.)

4093. "Directional wireless aerial systems." A. D. Blumlein and J. L. Pawsey. February 7th, 1934. (432978.)

4171. "Electrical musical instruments." J. Compton Organ Co., Ltd., and L. E. A. Bourn. February 8th, 1934. (433050.)

4180. "Electric immersion type liquid-heaters." Ferranti, Ltd., and W. B. Butterfield. February 8th, 1934. (433208.)

4219. "Electric radiators of the panel type." H. H. Berry. February 8th, 1934. (433056.)

4221. "Thermostatically operated switchgear." G. T. Church. February 8th, 1934. (432917.)

4332. "Electrical condensers." R. B. Peacock and Imperial Chemical Industries, Ltd. February 9th, 1934. (433140.)

4346. "Electric protective arrangements." Electrical Improvements, Ltd., and R. W. Gregory. February 9th, 1934. (433141.)

4393. "Manufacture of welded seam tubes." J. A. Dorrat and Associated Electrical Industries, Ltd. December 7th, 1934. (433145.)

4430. "Electro-acoustic translating devices." Electrical Research Products, Inc. February 28th, 1933. (433211.)

4433. "Apparatus for the electrical heat-treatment of metals." W. E. Burnand. February 10th, 1934. (433212.)

4607. "Automatic timing governor mechanism for magnetos and distributing heads of internal-combustion engines." British Thomson-Houston Co., Ltd., and L. Griffiths. February 12th, 1934. (433221.)

4622. "Electrical bus-bar conductors." London Electric Wire Co. & Smiths, Ltd., and E. L. Wildy. February 12th, 1934. (432918.)

4629. "Telephone systems." Standard Telephones & Cables, Ltd., A. E. J. Dixon and A. M. Searle. February 12th, 1934. (433223.)

4716. "Electric transformers." Electric Construction Co., Ltd., and E. Gledhill. February 13th, 1934. (433153.)

5164. "Electric switches for radio and like circuits." Ideal Werke Akt.-Ges. für Drahtlose Telephonie. February 22nd, 1933. (432919.)

5842. "Electric condensers." H. W. Sullivan, Ltd., and W. H. F. Griffiths. February 22nd, 1934. (432987.)

6247. "Electric heating units such as hotplates, immersion heaters, and the like." Vacuum Electric Corporation. June 14th, 1933. (433060.)

6564. "Lamps." Revo Electric Co., Ltd., and F. H. Reeves. March 1st, 1934. (433227.)

6566. "Pillars, posts or standards for electric street-lamps." Revo Electric Co., Ltd., and F. H. Reeves. March 1st, 1934. (432921.)

6569. "Control of selecting switches of the kind used in automatic telephone and other selective systems." Siemens Bros. & Co., Ltd., and H. E. Humphries. March 1st, 1934. (434158.)

7164. "Cathode-ray tubes for the production of pictures in colours, particularly for television and like systems." Fernseh Akt.-Ges. March 6th, 1933. (432989.)

7314. "Carrier-wave transmission systems." W. P. Wilson and F. M. G. Murphy. March 7th, 1934. (433064.)

7829. "Electric chronographs." General Electric Co., Ltd., R. C. Walker and C. R. Dunham. March 13th, 1934. (432922.)

8601. "Electric control systems." British Thomson-Houston Co., Ltd. March 18th, 1933. (433162.)

9106. "Wireless receiving apparatus." E. K. Cole, Ltd., and A. W. Martin. March 23rd, 1934. (433164.)

9626. "Wireless aerials." A. F. Kent. March 28th, 1934. (433068.)

10235. "Dielectric and cooling media for electrical apparatus." British Thomson-Houston Co., Ltd. April 4th, 1933. (433070.)

10236. "Dielectric and cooling media for electrical apparatus." British Thomson-Houston Co., Ltd. April 4th, 1933. (433071.)

11511. "Combined wash-hand basin and electrically-heated water tank." A. Low & Sons, Ltd., and D. W. Low. April 17th, 1934. (433075.)

13285. "Electric lamps." British Thomson-Houson Co., Ltd. May 3rd, 1933. (433233.)

14034. "Apparatus for transmitting and amplifying music." E. D. Alton. May 11th, 1933. (432926.)

14235. "Hand-microphone telephones." Siemens Bros. & Co., Ltd., W. E. Goodwin and E. A. Forceville. May 11th, 1934. (433234.)

15500. "Electrical systems of remote supervision." General Electric Co., Ltd., and N. C. Smart. May 24th, 1934. (433235.)

15503. "Regulating devices for electrical apparatus." General Electric Co., Ltd., and A. A. Chubb. May 24th, 1934. (432927.)

16237. "Electric-discharge lamps." Siemens Electric Lamps and Supplies, Ltd., and J. N. Aldington. May 31st, 1934 (Addition to 410558.) (432928.)

16401. "Photo-electric photometers." H. F. Tonnies. June 6th, 1933. (433236.)

17914. "Electrical apparatus for therapeutical purposes." V. Niculescu. June 16th, 1933 (Cognate application 17915/34.) (433002.)

19004. "Fuse cut-outs." C. A. Damey and W. J. Redwood. June 27th, 1934. (433087.)

19819. "Thermionic valves and circuit arrangements incorporating the same." Telefunken Ges. für Drahtlose Telegraphie. July 5th, 1933. (433089.)

23625. "Suction-cleaners." Hoover, Ltd., (Hoover Co.) August 16th, 1934. (433007.)

24749. "Electrically-driven turret clocks, high-duty or power-current time switches, and the like." Landis & Gyr Akt.-Ges. September 8th, 1933. (432932.)

25145. "Electric contact for maintaining the movement of electro-magnetically-oscillated movement of balance wheels." J. T. Delviniotti. September 5th, 1933. (Cognate application 25146/34.) (433098.)

27075. "Speed-controlling apparatus for alternating-current motors." R. Lee. September 20th, 1934. (433244.)

29438. "Electric welding or soldering of metal dentures permanently fixed in the mouth." A. Rakos. October 15th, 1934. (Convention date not granted.) (433247.)

30017. "Method of, and apparatus for electrically welding metals." W. J. Tarnant (Niagara Wire Weaving Co., Ltd.) October 19th, 1934. (433107.)

30189. "Electric motors." Desoutter Bros., Ltd., and C. Desoutter. October 22nd, 1934. (433014.)

30407. "Devices for adjusting the phase relationship between driving and driven shafts of teleprinter receivers." Siemens & Halske Akt.-Ges. October 23rd, 1933. (433108.)

31451. "Electric motors." Desoutter Bros., Ltd., and C. Desoutter. November 2nd, 1934. (433016.)

33528. "Microphones." Marconi's Wireless Telegraph Co., Ltd. November 21st, 1933. (432940.)

1935

2785. "Electric-discharge devices." General Electric Co., Ltd. February 15th, 1934. (432960.)

2788. "Electric lamps and discharge vessels." General Electric Co., Ltd., April 21st, 1934. (433260.)

5144. "Electrical submarine signalling cables." Electrical Research Products, Inc. February 27th, 1934. (Addition to 425639.) (433185.)

6178. "Apparatus for the directional transmission or reception of ultra-short electro-magnetic waves." Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken Meaf. March 3rd, 1934. (433026.)

9925. "Holders for multi-electrode electrical components." Stratton & Co., Ltd., and G. S. Laughton. March 30th, 1935. (433029.)

10240. "Traffic control signals." Automatic Electric Co., Ltd., and A. P. B. Renshaw. February 5th, 1934. (Divided out of 432900.) (432953.)

11376. "Intermediate-frequency thermionic amplifiers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 18th, 1934. (433273.)

11863. "Metal caps for electric incandescent lamps, electric-discharge devices, and the like." April 20th, 1934. (433274.)

12368. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. April 24th, 1934. (433033.)

Certification of Welders in Australia

THE Australian Welding Institute, N.S.W. Section, has adopted a syllabus for examination and certification of welding operators. The syllabus is similar to that in force in the Victorian Section where certification of welding operators has been in force for some time. The examination will be conducted by the Sydney Technical College. A committee representing public bodies, trades organisations, the Technical College, and the Australian Welding Institute is drawing up the details of the scheme.—*Electrical & Radio Trader* (Sydney).

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ashton-under-Lyne.—Offices, 73, Stamford Street, for Britannic Assurance Co., Ltd., Broad Street Corner, Birmingham; Cruikshank & Seward, architects, 18, Booth Street, Manchester.

Barnsley.—Church, Greenfoot Lane; incumbent of St. Paul's.

Bexhill-on-Sea.—Houses (29), London Road; William Pearce, borough surveyor.

Birkenhead.—Houses, Heath Drive, Upton; W. O. Jones & Son. Estate development in the vicinity of Wirral Way; Boultons (Prenton), Ltd.

Blackpool.—Houses (43), and garage, Macauley Avenue; H. Eckersley, builder, 41, Windermere Road, South Shore.

Bournemouth.—Development of Castle Lane Estate; Wessex Land, Ltd. Development of West Way Estate; Loader & Kiddle.

Bury.—Houses (98), Rhiwlas Estate; Bainbridge Bros., builders, Rhiwlas Estate.

Bushey Heath (HERTFORDSHIRE).—Extensions to hospital; W. F. Abbott, hon. treasurer.

Canterbury.—Telephone exchange, Stour Street, for H.M. Office of Works, King Charles Street, London, S.W.1.

Chesterfield.—Cinema, Cavendish Street, electrical work; J. Owen Bond, architect, Norwich.

Clitheroe.—Dairy, Chaigley (£50,000); Co-operative Wholesale Society, Ltd.

Cornwall.—Additions to Stretton C. of E. schools; H. R. Venning, architect, Midland Bank Chambers, Liskeard.

Cramlington (NORTHUMBERLAND).—Houses (630) for Hartley Main Collieries, Ltd.; staff architects, Mining Offices, Benton, Newcastle-on-Tyne.

Crewe.—School, Underwood Lane (500 places); director of education.

Darlaston.—Houses (300), Bentley, for Seaman Bros.; Skelding & Boucher, architects, 69, Bridge Street, Walsall.

Darlington.—Dog-racing track, Valley Street (£23,000); Darlington Sports Stadium, Ltd.

Dewsbury.—Extensions to dyeworks, Ravensthorpe; James Smith & Sons.

Dukinfield.—Houses, Jeffrey Street and Birch Lane; borough surveyor.

Dunstable.—R.C. church (electrical work); Willison & Titterton, builders.

Durham.—Hotel, near Finchale Priory; W. Rutherford, builder, Sea Road, Sunderland. Alterations and additions to the Alderman Wood Secondary School; F. Willey, county architect, 34, Old Elvet.

Dursley (GLOUCESTERSHIRE).—Houses (140); R.D.C. surveyor.

Ealing.—Development of Bellevue Estate; Percy Bilton, Ltd., 113, Park Street, W.1. Development of Rectory Estate; Hugh Dale & Co., 28, Station Approach, Sudbury.

Eastbourne.—Alterations and additions to School of Domestic Economy, 1-13, Silverdale Road; Elliott & Archer, architects. Reconstruction of Barclays Bank, Victoria Place; P. D. Stonham & Son, architects.

East Sussex.—Electric lighting for institutions; P.A.C. Officer, West Street, Lewes.

Eccles.—Houses (24), Patricroft; Wilham Estates, Ltd.

Elgin.—Houses, South College site; A. J. Morrison, architect.

Ely (CARDIFF).—Factory for Concordia Electric Safety Lamp Co., Ltd.; Thomas & Morgan & Partners, architects, Pontypridd.

Essex.—Alterations and additions to Kelvedon Hatch School; county architect, Chelmsford.

Farnworth.—Houses (30), King Street; F. Ashton, surveyor, Town Hall.

Glasgow.—Houses, Muirend; James Laidlaw & Sons. School, Hartlaw Crescent, Hillington; education director. Enlargement to Crookston Institution; city engineer.

Glossop.—Business stores, for Montague Burton, Ltd., Leeds.

Greenock.—Houses (114), Market Street, Sir Michael Street, and Smiths Lane (£49,000); Dougall & Co., builders, Dumbarton.

Guildford.—Public offices; Coussmaker & Armstrong, architects, 36, High Street.

Haddington.—Houses (48), Amisfield Road; W. L. Hogg, burgh surveyor, Fire Station.

Hailsham.—Development of Ratton Estate, Babylon Down; Ratton Estate (Eastbourne), Ltd.

Hanwell.—Development of Cuckoo Estate; H. A. Steel, 162, Uxbridge Road, W.13.

Harpenden (HERTFORDSHIRE).—Public hall; U.D.C. surveyor.

Herne Bay.—Hospital (electrical work); G. E. Wallis & Sons, builders, Maidstone.

Higham Ferrers.—Boot factory and office block, John White, Ltd.; A. Sanders, Ltd., builders, Rushden.

Hinckley.—Houses (260), near Hawley Road, for R. H. Simmonds & Sons, New Road; R. C. Simmonds, architect, The Grove, Burbage.

Hoylake.—Houses (50), Carr Lane; Lloyd & Cross, builders, Birkenhead.

Huddersfield.—Houses, Sheepridge, and Alder Street, Fartown; borough engineer.

Hyde.—Houses (60), Slate Acre Estate, near Joel Lane, Werneth Low; F. Booth & Son, builders, Rowbotham Street, Gee Cross.

Ilford.—Extensions to laundry, Redbridge Lane; Royal Jersey Laundry, Ltd.

Irish Free State (WEXFORD).—Motor axle and spring factory; Brockhouse (Ireland), Ltd.

Kent.—School, Petham; county architect, Maidstone. Rebuilding Dover institution for C.C.; W. H. Robinson, county architect, Springfield, Maidstone.

Keswick (CUMBERLAND).—Houses (38), Brigham; J. Peascod, architect.

Kettering.—Cinema (2,000 seats); Gaumont British Corporation, Ltd.

Lancaster.—Extension to senior and junior schools, Skerton; director of education.

Leeds.—Development of Waincliffe Estate, Dewsbury Road; J. W. Wilson & Sons. Shops, Oakwood Lane; G. Monkman & Sons.

Leicester.—Houses, Barbar Avenue and Uppingham Road (£300,000); Sheriff & Co., Ltd., builders, Gipsy Lane.

Liverpool.—Furniture factory, Hillfoot Road, for M. & S. Shifrin; Neville Holt, architect.

Luton.—Houses (46); H. Pickering, R.D.C. surveyor, 73, West Parade, Dunstable.

Macclesfield.—Houses (200), Moss Lane Housing Estate; E. Hamson, borough surveyor, Town Hall. Additions to factory, Lyon Street, for G. Godwin & Sons; Cooper Bros., builders, Catherine Street.

Maidstone.—Extensions to West Kent Hospital, for the Board of Management; secretary.

Manchester.—Flats, West Gorton and Collyhurst; housing director. Shops and houses, Middleton Road and Blackey New Road, Crumpsall; Roberts & Wood, architects, 26, King Street. Elementary school, Bowker Street; city architect.

Melton Mowbray.—Houses (60); R.D.C. surveyor, Nottingham Street.

Middlesbrough.—Alterations and additions to bus depôt, Parliament Street; S. E. Burgess, borough engineer.

Neath.—Houses (22); Clerk to Council, 8, New Street.

Newcastle-under-Lyme.—Houses (166), Hempstalls Lane; town clerk.

Northampton.—Extensions to Boarding School, Abington Street; Community of Notre Dame. Extensions to Nunn Mills, Bedford Road; Westley Bros. & Clarke.

North Riding.—Police courts, Northallerton, for C.C. (£23,000); G. W. Lazenby, Ltd., builders, Ferryhill.

Norton-on-Tees.—Houses (32); H. Stubbing, builder, Norton-on-Tees.

Nottingham.—Operating theatre, City Hospital, Hucknall Road, and additions to North Wilford Power Station; R. M. Finch, city engineer, Guildhall.

Oxford.—Extensions to Eagle Iron Works, Walton Well Road; W. Lucy & Co., Ltd.

Paisley.—Houses (160), Ferguslie; Houston & Young, Ltd., builders, Barrhead.

Pembroke Dock.—Workshops, stores, &c.; Air Ministry, Kingsway, London, W.C.2.

Peterborough.—Extensions to Westwood Engineering Works, electrical work, for Baker, Perkins, Ltd., engineers.

Pontypridd.—Houses (40), Cilfynydd and Maesycoed; Council's surveyor.

Portheawl.—Hotel, Mackworth Road; R. O. Clarke.

Rawdon (YORKSHIRE).—Houses, Larkfield Estate; surveyor, Council offices.

Reigate.—Enlargement to South Park School; Vincent Hooper & Son, architects.

Renfrew.—Houses (64), Thornliebank; Houston & Young, Ltd., builders, Barrhead.

Ripley (NEAR DERBY).—Public bath, Waterworks site; K. M. B. Cross, architect, 41, New Bond Street, London, W.1.

Rochester (STAFFORDSHIRE).—School library for the Board of Governors, Abbotsholme School, Abbotsholme; Isaac Massey & Sns, Ltd., builders, Alderley Edge, Cheshire.

Rothie-Norman.—Church, for Church of Scotland; Bennett Mitchell, architect.

Runcorn (CHESHIRE).—Houses (52), Halton Road Estate; A. B. Cunningham, surveyor, Town Hall.

Ryton-on-Tyne.—Houses (50), Reasby Field; R. Carse & Sons, builders, Amble.

Southport.—Estate development, Bradley Street; R. Marshall & Sons.

Spalding.—Houses (82) and two blocks of flats; R. W. Hastings, clerk.

Stourbridge.—Houses (74), Cemetery Road, Lye; F. Woodward, borough engineer.

Sunderland.—Flats (500), rehousing scheme, East End (£210,000), with electrical work; J. E. Lewis, borough engineer. Alterations and additions to Smith's, Ltd., High Street West; Waggott Brothers, builders, Bonners' Field. Extensions to factory premises, for M. Davis & Son, Stamp Lane; G. E. Matkin, architect, Fawcett Street.

Surrey.—Secondary school for girls, Sutton (£41,500); County architect, Kingston-on-Thames.

Tendring (ESSEX).—Houses (20), Little Clacton; F. G. Vincent Brown, architect, Dovercourt Bay.

Todmorden.—Baths; borough engineer.

Uttoxeter.—Branch Co-operative Stores, Ashbourne Road, for the Derby Co-operative Provident Society, Ltd., Albion Street, Derby; Building Dept., Co-operative Society, Ltd., Bridge Gate Works, Derby.

Wakefield.—Public baths, Sun Lane; P. Morris, architect, Town Hall.

Warminster (WILTS).—Houses (34); R. Butcher & Son, builders.

Warrington.—Houses (27), Croft and Burtonwood; Jn. Berry, housing surveyor, Church Street, Leigh, Lancashire.

Warwickshire.—Junior school, Atherstone, and enlargement to Sharmans Cross School, Solihull; county architect.

Winsford.—Extensions to Albert Infirmary; Tinker & Young, Ltd., builders, Monsall Street, Miles Platting, Manchester.

Wraysbury (BUCKINGHAMSHIRE).—Talking cinema studio, Ankerwyke; Grundy, Kershaw, Samson & Co., Ltd., Austin Friars, London, E.C.2.

York.—Houses (260), Nunthorpe Estate, by H. Williamson. Heworth Green.